DOCUMENT RESUME

ED 092 412 SE 018 071

AUTHOR Kilpatrick, Jeremy; Suydam, Marilyn N.
TITLE Reports on Mathematics Education Literature, 1969-1973.
PUB DATE [74]
NOTE 91p.

EDRS PRICE MF-$0.75 HC-$4.20 PLUS POSTAGE
DESCRIPTORS *Bibliographies; *Instruction; *Literature Reviews; Mathematics; *Mathematics Education; Reference Materials; Research Reviews (Publications); *State of the Art Reviews; Teacher Education; Teaching Methods; Textbooks

ABSTRACT

This document consists of six reports on literature published in the United States each year from 1969 through 1973 on the pedagogy of mathematics. These reports were prepared for the German publication, ZENTRALBLATT FUR DIDAKTIK DER MATHEMATIK. In each report, the literature is briefly reviewed under five categories: mathematics textbooks for teachers, books for professional reading, books on teaching methodology, books on research in mathematics education, and committee and conference reports. Each report contains an extensive list of references. (Author/DT)

ED 092412

Reports on Mathematics Education Literature, 1969 - 1973

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Jeremy Kilpatrick
Teachers College, Columbia University

Marilyn N. Suydam
The Ohio State University

This document consists of six reports which survey the literature that was published in the United States each year from 1969 through 1973 on the pedagogy of mathematics. These reports were prepared for the German publication, Zentralblatt für Didaktik der Mathematik (ZDM). The first four reports (1969-1971) were authored by Jeremy Kilpatrick; the other two (1972-1973) were prepared by Marilyn N. Suydam.

In each report, the literature is briefly reviewed under five categories:

1. Mathematics textbooks for teachers
2. Books for professional reading
3. Books on teaching methodology
4. Books on research in mathematics education
5. Committee and conference reports

Each report contains an extensive list of references.

SE 018 071

Zentralblatt für Didaktik der Mathematik

Report on the Literature in the United States, 1969

This survey of American literature on the pedagogy of mathematics covers publications appearing during the calendar year 1969. In order to keep the report within manageable limits, school and college mathematics textbooks, unless they are of special interest to teachers, and journal articles are not included. Readers interested in recent college mathematics textbooks should consult the Reviews in the American Mathematical Monthly. The Arithmetic Teacher, the Mathematics Teacher, and School Science and Mathematics contain lists and reviews of recent school mathematics textbooks.

The survey is organized according to the following categories:

1. Mathematics textbooks for teachers
2. Books for professional reading
3. Books on teaching methodology
4. Books on research in mathematics education
5. Committee and conference reports

1. Mathematics textbooks for teachers

The most influential force in revising teacher training programs in the United States during the last decade has been the Committee on the Undergraduate Program in Mathematics (CUPM) of the Mathematical Association of America. Recommendations by the CUPM have prompted many colleges to revise and extend their mathematics courses for teachers. The recommendations have also inspired a growing flood of textbooks for these new courses. For the college training of elementary school teachers, the CUPM suggests:

(1) a two-course sequence on the structure of the real number system and its subsystems, (2) a course on the basic concepts of algebra, and (3) a course in informal geometry. Some textbooks have been specifically designed to meet the criteria for one of these courses, some treat selected topics from several courses, and some were devised for other purposes, but acknowledge CUPM's influence. Strict categorization, therefore, is difficult.

Brumfiel and Krause's book [1] provides an outstanding example of how challenging mathematical ideas can be made appealing and intelligible to prospective elementary school teachers. Devoted primarily to the development of number systems, with chapters on number theory, geometry, and probability, the book combines a stimulating presentation of mathematics with illustrations from elementary school teaching and discussions of "stages of abstraction" in mathematics learning. Of the seven other books that can be classed in the same genre, [2] to [8], those by Kenyon [4] and by Webber and Brown [8] are notable for the inclusion of substantial material on geometry, and the Paige, Willcutt, and Wagenblast book [5] is accompanied by six supplementary programmed booklets that could be used in any elementary course.

A completely programmed course in algebra [9], developed as part of the Minnesota Mathematics and Science Teaching Project and tested extensively with preservice and inservice teachers, has been placed on the market in its latest edition, together with a Summary Textbook. The course treats the basic ideas of algebra, with emphasis on the real number system. A similar textbook, not programmed, was designed by Wren and Lindsay [10] for a one-semester course in algebra for upper elementary and junior high school teachers. More advanced, and probably more appropriate for secondary school teachers, is the textbook by Larsen [11].

Three textbooks, [12] to [14], follow rather closely the CUPM recommendations for a course in informal geometry. Rosskopf, Levine, and Vogeli [13] give special attention to logic and include three chapters on transformation geometry. In contrast to these books, Choquet's Geometry in a Modern Setting [15] is intended primarily for secondary school teachers; it exhibits the Bourbakian, algebraic approach to geometry. More traditional, Euclidean approaches to geometry can be found in two textbooks, [16] and [17], that, although intended primarily for ordinary college geometry courses, could be used in teacher training courses.

The CUPM has also suggested, as an elective for secondary school teachers, a one-semester course on number theory. Two books, [18] and [19], are competent additions to the available titles. Neither requires much background in mathematics; both contain ample material for a one-semester course.

Prospective teachers frequently elect college courses in mathematics for liberal arts students, and writers of textbooks for such courses have begun to consider the CUPM recommendations. One of the most popular textbooks for liberal arts students, Mathematics: The Man-made Universe [20], has now appeared in a second edition. Not only is the approach to mathematics fresh and appealing, but the topics treated can easily be adapted by teachers for classroom use. Other textbooks for courses in precalculus mathematics that can be used either in liberal arts courses or in courses for secondary school teachers are two new books, [21] and [22], and two revisions of popular works, [23] and [24]. In a departure from the format usual in such textbooks, Excursions into Mathematics [25] contains essays on six topics: polyhedra, perfect numbers, area, geometries, games, and numeration systems. Each essay

begins with elementary notions and moves, in a lively, informal fashion, into some complex and beautiful mathematics. The first of a two-volume series, Mathematics for the Social and Behavioral Sciences [26], presents a complete introduction to probability and statistics, and a sketchy introduction to calculus, using problems from the social sciences to illustrate the mathematics. Teachers looking for "real world" applications of mathematics should find the book valuable.

Among the host of other college mathematics textbooks produced in the United States in 1969, we cite only a few that are worthy of special attention by teachers. Bers's Calculus [27] is a first-rate addition to an overcrowded field. His thesis: "Calculus is the art of setting up and solving differential equations." Blackwell's Basic Statistics [28] takes the student with a modest background in mathematics through an intuitive, nicely-organized presentation of the main ideas of statistics. Coxeter's Introduction to Geometry [29] is an updated version of a well-known undergraduate textbook that teachers should find useful as a reference. Six other textbooks, [30] to [35], all dealing with precalculus topics, might serve either as reference works or for independent study.

2. Books for professional reading

The best general guide to reference sources, How to Find Out in Mathematics [36], has been brought up-to-date and reissued. Also reissued, in a paperback edition, is the classic Soviet survey Mathematics: Its Content, Methods, and Meaning [37]. Both works belong on the teacher's reference shelf.

One book on the philosophy of mathematics appeared during 1969 that teachers might find helpful: the collection of papers edited by Hintikka [38]. The papers, although technical, convey a clear sense of current thought in the philosophy of mathematics.

Several titles in the history of mathematics appeared in 1969. The thirty-first yearbook of the National Council of Teachers of Mathematics (NCTM), Historical Topics for the Mathematics Classroom [39], contains eight chapters on the history of various fields of mathematics supplemented by 120 "capsule" histories of selected topics. The yearbook should prove invaluable both as a reference work and as a textbook for courses in the history of mathematics. The comprehensive, scholarly source book by Struik [40] reprints original texts in mathematics for the six centuries before 1800. Many of the texts appear in English for the first time. Three books, [41] to [43], deal with the history of special topics; one textbook [44] attempts a comprehensive survey.

The thirtieth NCTM yearbook [45] also appeared in 1969. Like the twenty-ninth, in 1964, it comprises articles on some of the central unifying concepts in mathematics written for elementary school teachers and published previously as separate booklets. Of the ten articles in the thirtieth yearbook, the one entitled "Hints for Problem Solving" is easily the most original and provocative. The yearbook, designed for independent study, can also be used with its companion volume in teacher training courses.

The two-volume work by Eves, In Mathematical Circles [46], contains 360 little stories about mathematics and mathematicians that teachers can use in the classroom. Teachers might also wish to reread, and recommend to their students in its inexpensive paperback edition, Hardy's A Mathematician's Apology [47], with a foreword by C. P. Snow. Two books for the "literate layman," The Spirit and the Uses of the Mathematical Sciences [48] and The Mathematical Sciences: A Collection of Essays [49], contain cogent expositions of modern mathematical

thought, research, and applications that will interest the mathematically literate professional. The third American edition of Steinhaus's classic Mathematical Snapshots [50] presents many interesting mathematical ideas in an attractive format. And C. Stanley Ogilvy, whose books for the layman have been valuable sources of ideas for teachers, has come up with a new book on geometry [51] that continues his unique combination of scholarly standards and lucid writing.

Not for the layman, but useful for the well-prepared teacher, are three recent books. Dieudonné's book [52], addressed to mathematics teachers in France, has appeared in an English translation after five years. Dieudonné proposes a course in geometry for secondary schools based on the vector space approach. Since his arguments are beginning to be implemented in experimental curricula, his work deserves serious study by mathematics educators. A collection of papers on calculus drawn from the first 75 volumes of the American Mathematical Monthly and the first 40 volumes of the Mathematics Magazine has been assembled by a distinguished editorial panel and published by the Mathematical Association of America [53]. Every calculus teacher will find the collection indispensible. Also produced by the MAA is a collection of papers on contemporary research in number theory [54]. Some previous acquaintance with number theoretic ideas is necessary for understanding most of the papers.

Books that a high school teacher might wish to read and pass on to his students as supplementary reading include a second collection of original puzzle problems by Barr [55], an introduction to cryptanalysis (the twenty-second volume in the monograph project of the School Mathematics Study Group) [56], and two translations of Soviet works in the Library of School Mathematics series, [57] and [58].

Of the school mathematics textbooks published during 1969, six merit special attention. An unusual experimental geometry textbook for high school honors students has been published commercially [59]. It develops geometry from a small number of axioms using affinities and algebraic concepts. An adaption of a School Mathematics Study Group (SMSG) textbook Algorithms, Computation, and Mathematics has also been published commercially [60]. Preliminary editions appeared during the year of SMSG's Calculus of Elementary Functions [61]--designed for the College Entrance Examination Board's Calculus AB advanced placement syllabus--and Secondary School Mathematics: Sample Chapters [62]--illustrative of SMSG's "second round" of junior high school curriculum reform. Another experimental curriculum reform project is the Secondary School Mathematics Curriculum Improvement Study (SSMCIS), which has published a revised edition of its ninth-grade course [63] and an experimental edition of its tenth-grade course [64]. SSMCIS, heavily influenced by recent developments in European secondary school curricula, is developing a six-year unified mathematics program for talented students.

3. Books on teaching methodology

One of the most interesting books on teaching to appear in recent years is Biggs and MacLean's Freedom to Learn [65], which is designed to help teachers recenter their textbook-and teacher-dominated mathematics programs around the activities of children. Numerous examples and practical suggestions enhance the book's value. A laboratory manual [66] for a course in number systems for elementary school teachers is listed here, rather than with the textbooks, because it has proved to be a useful device for acquainting teachers with the mathematics laboratory approach. The

manual is certain to be widely used and copied. Other methodological works are, at the elementary school level, the books by Collier and Lerch [67], by Feldman [68], and by Vigilante [69]; and, at the secondary school level, the book by Fremont [70].

4. Books on research in mathematics education

Several reviews of research in mathematics education, [71] to [74], and a journal of abstracts, [75], were published during the year. Reports from the National Longitudinal Study of Mathematical Abilities, conducted by SMSG, [76] to [78], continue to appear at intervals. SMSG has also undertaken, together with the Survey of Recent East European Mathematical Literature, the translation of Soviet pedagogical studies in mathematics education. The first three of a series of fifteen volumes have been published, [79] to [81].

Explications for educators of Piaget's thought and work have mushroomed recently. Four that mathematics educators may find helpful are listed, [82] to [85].

The summer institute program established by the National Science Foundation for the inservice training of secondary science and mathematics teachers is a major success story in recent American education. A history by Krieghbaum and Rawson [86] of the first dozen years of the program, from 1954 to 1965, makes interesting reading.

5. Committee and conference reports

We conclude by mentioning three committee reports and two conference reports. The committee reports, [87] to [89], are three additions by the CUPM to is distinguished series of recommendations for

college mathematics programs. The two conference reports, [90] and [91], are the report of the Cambridge Conference on the Correlation of Science and Mathematics in the Schools, held August 21 to September 8, 1967, in Brookline, Massachusetts; and the proceedings of the National Conference on Computer-Assisted Instruction, held September 24 to 26, 1968, at Pennsylvania State University.

J. Kilpatrick, New York

References

[1] Brumfiel, C. F., & Krause, E. F. Elementary mathematics for teachers. Reading, Mass.: Addison-Wesley, 1969.

[2] Garner, M. V. Mathematics for elementary teachers. Pacific Palisades, Calif.: Goodyear, 1969.

[3] Keedy, M. L. Number systems: A modern introduction. (2nd ed.) Reading, Mass.: Addison-Wesley, 1969.

[4] Kenyon, A. E. Modern elementary mathematics. Englewood Cliffs, N. J.: Prentice-Hall, 1969.

[5] Paige, D. D., Willcutt, R. E., & Wagenblast, J. M. Elementary mathematics. Boston: Prindle, Weber & Schmidt, 1969.

[6] Pettofrezzo, A. J., & Hight, D. W. Number systems: Structure and Properties. Glenview, Ill.: Scott, Foresman, 1969.

[7] Vick. G. R. Elementary mathematical structure. Columbus: Merrill, 1969.

[8] Webber, G. C. & Brown, J. A. Number concepts and geometry. Reading, Mass.: Addison-Wesley, 1969.

[9] Mewborn, A. C. A programmed course in algebra. Reading, Mass.: Addison-Wesley, 1969.

[10] Wren, F. L., & Lindsay, J. W. Basic algebraic concepts. New York: McGraw-Hill, 1969.

[11] Larsen, M. D. Introduction to modern algebraic concepts. Reading, Mass.: Addison-Wesley, 1969.

[12] Ohmer, M. M. Elementary geometry for teachers. Reading, Mass.: Addison-Wesley, 1969.

[13] Rosskopf, M. F., Levine, J. L. & Vogeli, B. R. Geometry: A perspective view. New York: McGraw-Hill, 1969.

[14] Stubblefield, B. An intuitive approach to elementary geometry. Belmont, Calif.: Brooks/Cole, 1969.

[15] Choquet, G. Geometry in a modern setting. Boston: Houghton Mifflin, 1969.

[16] Jolly, R. F. Synthetic geometry. New York: Holt, Rinehart & Winston, 1969.

[17] Tryon, C. W. Elementary geometry for college. New York: Harcourt, Brace & World, 1969.

[18] Barnett, I. A. Elements of number theory. Boston: Prindle, Weber & Schmidt, 1969.

[19] Dudley, U. Elementary number theory. San Fransicso: Freeman, 1969.

[20] Stein, S. K. Mathematics: The man-made universe. (2nd ed.) San Francisco: Freeman, 1969.

[21] Crowdis, D. G., & Wheeler, B. W. Introduction to mathematical ideas. New York: McGraw-Hill, 1969.

[22] Fraleigh, J. B. Mainstreams of mathematics. Reading, Mass.: Addison-Wesley, 1969.

[23] Meserve, B. E., & Sobel, M. A. Introduction to mathematics. (2nd ed.) Englewood Cliffs, N. J.: Prentice-Hall, 1969.

[24] Schaaf, W. L. Basic concepts of elementary mathematics. (3rd ed.) New York: Wiley, 1969.

[25] Beck, A., Bleicher, M. N., & Crowe, D. W. Excursions into mathematics. New York: Worth, 1969.

[26] Gelbaum, B. R., & March, J. G. Mathematics for the social and behavioral sciences. Vol. 1 Probability, calculus and statistics. Philadelphia: Saunders, 1969.

[27] Bers, L. Calculus. New York: Holt, Rinehart & Winston, 1969.

[28] Blackwell, D. Basic statistics. New York: McGraw-Hill, 1969.

[29] Coxeter, H. S. M. Introduction to geometry. (2nd ed.) New York: Wiley, 1969.

[30] Abbott, J. C. Sets, lattices, and Boolean algebras. Boston: Allyn & Bacon, 1969.

[31] Auslander, L. What are numbers? Glenview, Ill.: Scott, Foresman, 1969.

[32] Dodge, C. W. Numbers and mathematics. Boston: Prindle, Weber & Schmidt, 1969.

[33] Dorf, R. C. Matrix algebra: A programmed introduction. New York: Wiley, 1969.

[34] Farina, M. V. Computers: A self-teaching introduction. Englewood Cliffs, N. J.: Prentice-Hall, 1969.

[35] Selby, S., & Sweet, L. Sets--relations--functions. (2nd ed.) New York: McGraw-Hill, 1969.

[36] Pemberton, J. E. How to find out in mathematics. (2nd rev. ed.) Elmsford, N. Y.: Pergamon, 1969.

[37] Aleksandrov, A. D., Kolmogorov, A. N., & Lavrent'ev, M. A. (Eds.) Mathematics: Its content, methods, and meaning. Cambrdige, Mass.: M.I.T. Press, 1969. 3 vols.

[38] Hintikka, J. (Ed.) The philosophy of mathematics. New York: Oxford University Press, 1969.

[39] National Council of Teachers of Mathematics. Historical topics for the mathematics classroom. Thirty-first yearbook. Washington, D. C.: NCTM, 1969.

[40] Struik, D. J. (Ed.) A source book in mathematics: 1200-1800. Cambridge, Mass.: Harvard University Press, 1969.

[41] Bold, B. Famous problems of mathematics: A history of constructions with straight edge and compasses. Princeton, N. J.: Van Nostrand, 1969.

[42] Menninger, K. Number words and number symbols: A cultural history of numbers. Cambridge, Mass.: M.I.T. Press, 1969.

[43] Smith, D. E. Number stories of long ago. Classics in mathematics education, No. 2. Washington, D.C.: NCTM, 1969.

[44] Eves, H. An introduction to the history of mathematics. (3rd ed.) New York: Holt, Rinehart & Winston, 1969.

[45] National Council of Teachers of Mathematics. More topics in mathematics for elementary school teachers. Thirtieth yearbook. Washington, D. C.: NCTM, 1969.

[46] Eves, H. In mathematical circles. Boston: Prindle, Weber & Schmidt, 1969. 2 vols.

[47] Hardy, G. H. A mathematician's apology. New York: Cambridge University Press, 1969.

[48] Saaty, T. L., & Weyl, F. J. (Eds.) The spirit and the uses of the mathematical sciences. New York: McGraw-Hill, 1969.

[49] National Research Committee on Support of Research in the Mathematical Sciences. (Eds.) The mathematical sciences: A collection of essays. Cambridge, Mass.: M.I.T. Press, 1969.

[50] Steinhaus, H. Mathematical snapshots. (3rd American ed.) New York: Oxford University Press, 1969.

[51] Ogilvy, C. S. Excursions in geometry. New York: Oxford University Press, 1969.

[52] Dieudonné, J. Linear algebra and geometry. Boston: Houghton Mifflin, 1969.

[53] Apostol, T. M., Chrestenson, H. E., Ogilvy, C. S., Richmond, D. E., & Schoonmaker, N. J. (Eds.) Selected papers on calculus. Belmont, Calif: Dickenson, 1969.

[54] LeVeque, W. J. (Ed.) Studies in number theory. MAA studies in mathematics, Vol, 6. Englewood Cliffs, N. J.: Prentice-Hall, 1969.

[55] Barr, S. Second miscellany of puzzles: Mathematical and otherwise. London: Macmillan, 1969.

[56] Sinkov, A. Elementary cryptanalysis: A mathematical approach. New mathematical library, No. 22. New York: Random House, 1969.

[57] Gelfand, I. M., Glagoleva, E. G., & Shnol, E. E. Functions and Graphs. Library of school mathematics, Vol. 2. Cambridge, Mass.: M.I.T. Press, 1969.

[58] Gelfand, S. I., Gerver, M. L., Kirillov, A. A., Konstantinov, N. N., & Kushnirenko, A. G. Sequences, combinations, limits. Library of school mathematics, Vol. 3. Cambridge, Mass.: M.I.T. Press, 1969.

[59] Modern coordinate geometry. A Wesleyan experimental curricular study Boston: Houghton Mifflin, 1969.

[60] Forsythe, A. I., Kennan, T. A., Organick, E. I., & Stenberg, W. Computer Science: A first course. New York: Wiley, 1969.

[61] School Mathematics Study Group. Calculus of elementary functions. Stanford, Calif.: SMSG, 1969.

[62] School Mathematics Study Group. Secondary school mathematics: Sample chapters. Stanford, Calif.: SMSG, 1968, 1969.

[63] Secondary School Mathematics Curriculum Improvement Study. Unified modern mathematics. Course 3. (Rev. ed.) New York: Teachers College Press, 1969.

[64] Secondary School Mathematics Curriculum Improvement Study. Unified modern mathematics. Course 4. New York: Teachers College Press, 1969.

[65] Biggs, E. E., & MacLean, J. R. Freedom to learn: An active learning approach to mathematics. Reading, Mass.: Addison-Wesley, 1969.

[66] Fitzgerald, W. M., Bellamy, D. P., Boonstra, P. H., Jones, J. W., & Oosse, W. J. Laboratory manual for elementary mathematics. Boston: Prindle, Weber & Schmidt, 1969.

[67] Collier, C. C., & Lerch, H. H. Teaching mathematics in the modern elementary school. London: Macmillan, 1969.

[68] Feldman, L. (Ed.) Mathematical learning: New approaches to the teaching of young children. New York: Gordon & Breach, 1969.

[69] Vigilante, N. J. (Ed.) Mathematics in elementary education: Selected readings. London: Macmillan, 1969.

[70] Fremont, H. How to teach mathematics in secondary schools. Philadelphia: Saunders, 1969.

[71] Atkin, J. M. & Romberg, T. A. (Eds.) Science and mathematics education. Review of Educational Research, 1969, 39, No. 4.

[72] Henderson, K. B. Teaching secondary school mathematics. What research says to the teacher, No. 9. Washington, D. C.: National Educational Association, Association of Classroom Teachers, 1969.

[73] Willoughby, S. S. Mathematics. In R. L. Ebel (Ed.), Encyclopedia of educational research. (4th ed.) London: Macmillan, 1969. Pp. 766-777.

[74] Wilson, J. W., & Carry, L. R. (Eds.) Reviews of recent research in mathematics education. Studies in mathematics, Vol. 19. Stanford, Calif.: SMSG, 1969.

[75] Weaver, J. F. (Ed.) Investigations in mathematics education: A journal of abstracts and annotations. Stanford, Calif.: SMSG, January 1969, Vol. 1; June 1969, Vol 2.

[76] Romberg, T. A., & Wilson, J. W. The development of tests. NLSMA reports, No. 7. Stanford, Calif.: SMSG, 1969.

[77] Carry, L. R., & Weaver, J. F. Patterns of mathematics achievement in grades 4, 5, and 6: X-Population. NLSMA reports, No. 10. Stanford, Calif.: SMSG, 1969.

[78] McLeod, G. K., & Kilpatrick, J. Patterns of mathematics achievement in grades 7 and 8. Y-Population. NLSMA reports, No. 12, Stanford, Calif.: SMSG, 1969.

[79] Kilpatrick, J., & Wirszup, I. (Eds.) The learning of mathematical concepts. Soviet studies in the psychology of learning and teaching mathematics, Vol. 1. Stanford, Calif.: SMSG, 1969.

[80] Kilpatrick, J., & Wirszup, I. (Eds.) The structure of mathematical abilities. Soviet studies, Vol. 2. Stanford, Calif.: SMSG, 1969.

[81] Kilpatrick J., & Wirszup, I. (Eds.) Problem solving in arithmetic and algebra. Soviet studies, Vol. 3. Stanford, Calif.: SMSG, 1969.

[82] Beard, R. M. An outline of Piaget's developmental psychology for students and teachers. New York: Basic Books, 1969.

[83] Furth, H. Piaget and knowledge: Theoretical foundations. Englewood Cliffs, N. J.: Prentice-Hall, 1969.

[84] Ginsburg, H., & Opper, S. Piaget's theory of intellectual development: An introduction. Englewood Cliffs, N. J.: Prentice-Hall, 1969.

[85] Phillips, J. L., Jr. The origins of intellect: Piaget's theory. San Francisco: Freeman, 1969.

[86] Kriegbaum, H., & Rawson, H. An investment in knowledge. New York: New York University Press, 1969.

[87] Committee on the Undergraduate Program in Mathematics. A transfer curriculum in mathematics for two-year colleges. Berkeley, Calif: CUPM, 1969.

[88] Committee on the Undergraduate Program in Mathematics. Qualifications for teaching university parallel mathematics courses in two-year colleges. Berkeley, Calif.: CUPM, 1969.

[89] Committee on the Undergraduate Program in Mathematics. A beginning graduate program for prospective teachers of undergraduates. Berkeley, Calif.: CUPM, 1969.

[90] Cambridge Conference on the Correlation of Science and Mathematics in the Schools. Goals for the correlation of elementary science and mathematics. Boston: Houghton Mifflin, 1969.

[91] Heimer, R. T. (Ed.) Computer-assisted instruction and the teaching of mathematics. Washington, D. C.: NCTM, 1969.

December 28, 1970
J. Kilpatrick

Zentralblatt für Didaktik der Mathematik

Report on the Literature in the United States, 1970, Part 1

This report surveys the literature on the pedagogy of mathematics that was published in the United States in the first three quarters of 1970. A subsequent report will treat the last quarter of 1970, picking up any publications that were missed in this survey.

As usual, the largest category of publications consists of textbooks for college mathematics courses. The number of such books published each year in the United States is so large that this survey must be limited to books explicitly designed for teacher education courses plus selected titles that might be of special interest to teachers. The other categories in the report are books for professional reading, methods books, books on research, and conference reports.

1. Mathematics textbooks for teachers

A baker's dozen new titles, [1] to [13], have been added to the rapidly growing number of textbooks for general mathematics courses that enroll liberal arts students or prospective teachers or both. Notable among these titles is Kelley and Richert's book [9], a unique blend of "content" and "methods" designed to be of direct assistance to elementary school teachers. Also worthy of special attention are the books by Armstrong [1] and Douglis [2], both organized around key ideas in mathematics. The books by Evans [3], Herrick [5], Jones [7], and Nichols [10], although aimed less at teacher education courses than the other books listed, deal with many of the same topics.

Three programmed books, [14] to [16], might be helpful to teachers taking general mathematics courses. The title of Hardy's book [15] is a little misleading since the book contains exercises in sets, relations, mappings, and number theory,

as well as group theory. Paige and Beattie's set of programmed booklets [16] is designed to accompany the Paige, Willcut, and Wagenblast book Elementary Mathematics published in 1969.

Two books on arithmetic, [17] and [18], and four on number theory, [19] to [22], could be used as textbooks in courses for teachers. Dutton, Petrie, and Adams's Arithmetic for Teachers [18] places particular stress on issues of instruction, but is somewhat thin in content. Vanden Eynden's Number Theory: An Introduction to Proof [22] is noteworthy for its attention to the heuristics of proof construction.

Teachers with little or no background in abstract algebra might find the textbook by Weiner [23] a useful introduction even though the book is not directed primarily at teachers or prospective teachers. A textbook for an integrated course in algebra and geometry for elementary and junior high school teachers has been developed by Brumfiel and Vance [24]. Colleges that have been offering separate courses in algebra and geometry, as recommended by the Committee on the Undergraduate Program in Mathematics (CUPM), may wish to experiment with an integrated course using the Brumfiel and Vance book. For those colleges that offer separate courses, four new textbooks, [25] to [28], have appeared that follow, more or less, the CUPM recommendations for a course in informal geometry for elementary school teachers.

Teachers of high school courses in elementary functions may find useful ideas in two college precalculus textbooks, [29] and [30]. The book by Sorgenfrey and Beckenbach [30] looks especially promising as a source of ideas. Applications of mathematics that high school teachers could use in their classes can be found in abundance in four new college textbooks, [31] to [34].

In particular, Mosteller, Rourke, and Thomas's well-known Probability with Statistical Applications [33] has been updated and expanded, and now includes projects that can be carried out on a computer. Since computer terminals are becoming fixtures in more and more high school classrooms these days, teachers may be interested in the book by Hull and Day [35] and the two books by Sterling and Pollack, [36] and [37] (which differ only in the computer language used). All three books introduce the reader to some fundamentals of computer science.

Calculus textbooks of all sorts continue to proliferate. Listed here are five, [38] to [42], that illustrate the turning away from rigor and formalism toward intuitive arguments and applications that is beginning to characterize American calculus textbooks. The two shortest of these--Lowengrub and Stampbli's Topics in Calculus [40] and Richmond's Calculus: A Short Course [41]-- are designed for one-semester courses for liberal arts students.

2. Books for professional reading

W. W. Sawyer has published the third book [41] in a series entitled Introducing Mathematics and designed to give the interested layman an idea of how mathematics works. Teachers will want to borrow many of Sawyer's inventive techniques. A more comprehensive treatment of modern mathematics, both pure and applied, for the general reader is Kramer's book [44].

Books on special topics are Buchanan's brief treatment of limits of sequences leading to infinite series and continuous functions [45]; DeLong's non-technical, descriptive account of mathematical logic, its history, and its import [46]; Bolt and Wardle's excellent introduction to computers and why they do that elementary school teachers could use with profit [47]; and

Bellman, Cooke, and Lockett's elementary introduction, through dynamic programming and graph theory, to computer methods used in operations research [48].

W. L. Schaaf has expanded to two volumes his well-known bibliography of some five thousand books, articles, and pamphlets on puzzle problems, mathematical curiosities, and other "recreational mathematics" [49]. Three recent books on recreational mathematics have also appeared, [50] to [52]. High school teachers may wish to read and pass on to their students a revision of a popular handbook on how to study mathematics [53].

3. Books on teaching methodology

Several recent books deal with methodology in the context of other concerns, but are cited in this section nonetheless. The thirty-second yearbook of the National Council of Teachers of Mathematics [54] traces the historical origins of current practices in mathematics education in the United States and Canada. It is a valuable book for anyone concerned with issues and problems in mathematics education. A useful accompaniment to the thirty-second yearbook, and published at the same time, is a collection of readings in the history of mathematics education [55], which contains reprints (mostly excerpts) of many notable and difficult-to-obtain documents, position papers, and committee reports. Another book of readings [56] reprints a heterogeneous collection of recent articles on the teaching of elementary school mathematics. The articles vary considerably in quality and usefulness, but they do give a comprehensive picture of the literature.

Part I of the sixty-ninth yearbook of the National Society for the Study of Education is entitled Mathematics Education [57] and contains thirteen essays for educators on various aspects of the revolution in school mathematics, ranging from an outline of the treatment of geometry in the curriculum to discussions of

problems of evaluation. Of the many fine chapters, two deserve special mention here: Lee Shulman's linkage of current issues in psychology to issues of mathematics instruction--destined to become a classic statement--and Henry Pollak's provocative discussion of applications of mathematics and the difficulties of getting them into the curriculum. Concluding this sequence of publications that have much to say about methodology, although they are not 'methods books,' is a pamphlet [58] aimed at informing elementary school principals and mathematics specialists about factors influencing the effectiveness of elementary school programs. Teachers and laymen should also find the pamphlet helpful.

A book missed in the review of the 1969 literature is DeVault and Kriewall's textbook that sets forth a systems approach to elementary school mathematics [59]. Among this year's crop of methodological works are two attempts to delineate the discovery approach, one for elementary school teachers [60] and one for secondary school teachers [61]; a methods course built on Piaget's work and emphasizing how children learn rather than how to teach [62]; an elaborate, theory-based exposition, using notions from Dewey and Piaget, of how problems can be used to capitalize on the child's natural motivation to learn mathematics [63]; and a comprehensive, useful guide to the laboratory approach in grades 5 through 9 [64].

4. Books on research in mathematics education

Eleven bulletins prepared as part of the Interpretive Study of Research and Development in Elementary School Mathematics [65] are available as a set. Each bulletin contains a discussion, at a level that teachers, principals, and supervisors can understand, of selected research findings on a given topic. Two reports of research have appeared in book form: Almy and associates' study of the effect of early instruction in science and mathematics on the later development of logical thinking [66], and Fey's analysis of the verbal interchanges between teachers and

students in seventh grade mathematics classes [67]. A valuable account of seminars on problem solving and productive thinking given by Max Wertheimer at the New School in New York in the late 1930's has just been issued in three volumes [68]. Wertheimer used many mathematical problems to illustrate his theories; few psychologists have more to say to mathematics educators about problem solving and how it might be taught.

As a footnote to this section, 1970 marked the appearance of the National Council of Teachers of Mathematics' Journal for Research in Mathematics Education, which clearly will do much to raise the level of the design and reporting of research in the field.

5. Conference reports

Only one report is listed: the report of a colloquium held at the University of Illinois College of Education in October 1969 that dealt with the preparation of teachers of mathematics teachers [69].

J. Kilpatrick, New York

References

[1] Armstrong, J. W. Elements of mathematics. New York: Macmillan, 1970.

[2] Douglis, A. Ideas in mathematics. Philadelphia: Saunders, 1970.

[3] Evans, J. P. Mathematics: Creation and study of form. Reading, Mass.: Addison-Wesley, 1970.

[4] Graham, M. Modern elementary mathematics. New York: Harcourt, Brace & World, 1970.

[5] Herrick, D. Mathematics for liberal arts students. Boston: Prindle, Weber & Schmidt, 1970.

[6] Hudson, F. M., & Adlong, D. W. Introduction to mathematics. Reading, Mass.: Addison-Wesley, 1970.

[7] Jones, B. W. Elementary concepts of mathematics. (3rd ed.) New York: Macmillan, 1970.

[8] Keedy, M. L., & Bittinger, M. L. Mathematics: A modern introduction. Reading, Mass.: Addison-Wesley, 1970.

[9] Kelley, J. L., & Richert, D. Elementary mathematics for teachers. San Francisco: Holden-Day, 1970.

[10] Nichols, E. D. College mathematics for general education. New York: Holt, Rinehart & Winston, 1970.

[11] Wheeler, R. E. Modern mathematics: An elementary approach. (2nd ed.) Belmont, Calif.: Brooks/Cole, 1970.

[12] Willerding, M. F. Elementary mathematics: Its structure and concepts. (2nd ed.) New York: Wiley, 1970.

[13] Youse, B. K. An introduction to mathematics. Boston: Allyn & Bacon, 1970.

[14] Abramson, M. A development of the rational number system. Boston: Holbrook, 1970.

[15] Hardy, F. L. Elementary exercises in group theory. Columbus, Ohio: Merrill, 1970.

[16] Paige, D. D., & Beattie, I. D. Programmed guide to elementary mathematics. Boston: Prindle, Weber & Schmidt, 1970.

[17] Brumfiel, C. F., & Krause, E. F. Introduction to the theory of arithmetic. Reading, Mass.: Addison-Wesley, 1970.

[18] Dutton, W. H., Petrie, C. C., & Adams, L. J. Arithmetic for teachers. (2nd ed.) Englewood Cliffs, N. J.: Prentice-Hall, 1970.

[19] Bolker, E. D. Elementary number theory: An algebraic approach. New York: W. A. Benjamin, 1970.

[20] Pettofrezzo, A. J., & Byrkit, D. R. Elements of number theory. Englewood Cliffs, N. J.: Prentice-Hall, 1970.

[21] Stark, H. M. An introduction to number theory. Chicago: Markham, 1970.

[22] Vanden Eynden, C. Number theory: An introduction to proof. Scranton, Penna.: International Textbook, 1970.

[23] Weiner, L. Introduction to modern algebra. New York: Harcourt, Brace & World, 1970.

[24] Brumfiel, C. F., & Vance, I. E. Algebra and geometry for teachers. Reading, Mass.: Addison-Wesley, 1970.

[25] Ballard, W. R. Geometry. Philadelphia: Saunders, 1970.

[26] Haag, V. H., Hardgrove, C. E., & Hill, S. A. Elementary geometry. Reading, Mass.: Addison-Wesley, 1970.

[27] Hartung, M. L., & Walch, R. Geometry for elementary teachers. Glenview, Ill.: Scott, Foresman, 1970.

[28] Johnson, P. B., & Kipps, C. H. Geometry for teachers. Belmont, Calif.: Brooks/Cole, 1970.

[29] Mohat, J. T. Elementary functions: An introduction. Reading, Mass.: Addison-Wesley, 1970.

[30] Sorgenfrey, R. H., & Beckenbach, E. F. Analysis of elementary functions. Boston: Houghton Mifflin, 1970.

[31] Hart, W. L. Mathematics for managerial and social sciences. Boston: Prindle, Weber & Schmidt, 1970.

[32] Hodges, J. L., Jr., & Lehmann, E. L. Basic concepts of probability and statistics. (2nd ed.) San Francisco: Holden-Day, 1970.

[33] Mosteller, F., Rourke, R. E. K., & Thomas, G. B. Probability with statistical applications. (2nd ed.) Reading, Mass.: Addison-Wesley, 1970.

[34] Searle, S. R., & Hausman, W. H. Matrix algebra for business and economics. New York: Wiley, 1970.

[35] Hull, T. E., & Day, D. D. F. Computers and problem solving. Reading, Mass.: Addison-Wesley, 1970.

[36] Sterling, T. D., & Pollack, S. V. Computing and computer science: A first course with PL/I. New York: Macmillan, 1970.

[37] Sterling, T. D., & Pollack, S. V. Computing and computer science: A first course with FORTRAN IV. New York: Macmillan, 1970.

[38] Flanders, H., Korfhage, R. R., & Price, J. J. Calculus. New York: Academic Press, 1970.

[39] Kaplan, W., & Lewis, D. J. Calculus and linear algebra. Vol. 1 Vectors in the plane and one-variable calculus. New York: Wiley, 1970.

[40] Lowengrub, M., & Stampfli, J. G. Topics in calculus. Waltham, Mass.: Ginn-Blaisdell, 1970.

[41] Richmond, D. E. Calculus: A short course. Reading, Mass.: Addison-Wesley, 1970.

[42] Riddle, D. F. Calculus and analytic geometry. Belmont, Calif.: Wadsworth, 1970.

[43] Sawyer, W. W. The search for pattern. Baltimore: Penguin, 1970.

[44] Kramer, E. E. The nature and growth of modern mathematics. New York: Hawthorn, 1970.

[45] Buchanan, O. L., Jr. Limits: A transition to calculus. Boston: Houghton, Mifflin, 1970.

[46] DeLong, H. A profile of mathematical logic. Reading, Mass.: Addison-Wesley, 1970.

[47] Bolt, A. B., & Wardle, M. E. Communicating with a computer. New York: Cambridge University Press, 1970.

[48] Bellman, R., Cooke, K. L., & Lockett, J. A. Algorithms, graphs, and computers. New York: Academic Press, 1970.

[49] Schaaf, W. L. A bibliography of recreational mathematics. 2 vols. Washington, D. C.: National Council of Teachers of Mathematics, 1970.

[50] Kadesch, R. R. Math menagerie. New York: Harper & Row, 1970.

[51] Longley-Cook, L. H. New math puzzle book. New York: Van Nostrand Reinhold, 1970.

[52] Mira, J. A. Mathematical teasers. New York: Barnes & Noble, 1970.

[53] Swain, H. How to study mathematics: A handbook for high school students. Washington, D. C.: National Council of Teachers of Mathematics, 1970.

[54] Jones, P. S. (Ed.) A history of mathematics education in the United States and Canada. Thirty-second yearbook. Washington, D. C.: National Council of Teachers of Mathematics, 1970.

[55] Bidwell, J. K., & Clason, R. G. (Eds.) Readings in the history of mathematics education. Washington, D. C.: National Council of Teachers of Mathematics, 1970.

[56] Kramer, K. (Ed.) Problems in the teaching of elementary school mathematics. Boston: Allyn & Bacon, 1970.

[57] Begle, E. G. (Ed.) Mathematics Education. Sixty-ninth yearbook of the National Society for the Study of Education, Part I. Chicago: University of Chicago Press, 1970.

[58] National Council of Teachers of Mathematics. Teaching mathematics in the elementary school. What's needed? What's happening? Washington, D. C.: NCTM, 1970.

[59] DeVault, M. V., & Kriewall, T. E. Perspectives in elementary school mathematics. Columbus, Ohio: Merrill, 1969.

[60] Kennedy, L. M. Guiding children to mathematical discovery. Belmont, California: Wadsworth, 1970.

[61] Fawcett, H. P., & Cummins, K. B. The teaching of mathematics from counting to calculus. Columbus, Ohio: Merrill, 1970.

[62] Copeland, R. W. How children learn mathematics: Teaching implications of Piaget's research. New York: Macmillan, 1970.

[63] Dwyer, R. C., & Elligett, J. K. Teaching children through natural mathematics. West Nyack, N. Y.: Parker, 1970.

[64] Kidd, K. P., Myers, S. S., & Cilley, D. M. The laboratory approach to mathematics. Chicago: Science Research Associates, 1970.

[65] Suydam, M. N., & Weaver, J. F. Using research: A key to elementary school mathematics. University Park, Penna.: Center for Cooperative Research with Schools, The Pennsylvania State University, 1970.

[66] Almy, M., and associates. Logical thinking in second grade. New York: Teachers College Press, 1970.

[67] Fey, J. T. Patterns of verbal communication in mathematics. New York: Teachers College Press, 1970.

[68] Luchins, A. S., & Luchins, E. H. Wertheimer's seminars revisited: Problem solving and thinking. 3 vols. Albany, N. Y.: Faculty-Student Association, State University of New York, 1970.

[69] Travers, K. J. (Ed.) The preparation of mathematics teacher educators. Urbana. University of Illinois College of Education, 1969.

Zentralblatt für Didaktik der Mathematik

Report on the Literature in the United States, 1970, Part 2; 1971, Part 1

By

Jeremy Kilpatrick

This report covers the last quarter of 1970 and the first quarter or so of 1971. It is intended as a fairly comprehensive survey of books on the pedagogy of mathematics that were published in the United States during the period. The titles surveyed include college mathematics textbooks appropriate for teacher education courses, books for professional reading, methodological works, reports of research, and committee and conference reports.

1. Mathematics textbooks for teachers

Like crabgrass in June, mathematics textbooks for teacher education courses continue to multiply. Allendoerfer's book [1] is unusual among the most recent crop of textbooks in elementary mathematics because it grew out of an attempt to design a "multimedia" course. The text materials, tested in classroom tryouts, include readiness tests, programmed exercises, and summary tests; thirteen supplementary films are available. Of the other general texts in elementary mathematics, [2] to [6],

Fletcher and Howell's book [2] is notable because it exemplifies the Nuffield approach as applied to teacher education, and Phelps' book [6] is different because it provides a condensed treatment of topics the other books treat in more detail: the real number system, informal geometry, and measurement. Moser's text [7] is designed for a first college course in Euclidean geometry.

For secondary school teachers, Hall and Szabo [8] have used isometries to develop Euclidean plane geometry, Peterson [9] has written a careful introduction to fundamental concepts of number theory and modern algebra, and Sloyer [10] has organized a problem-centered approach to many of the same concepts. A truly monumental work is Griffiths and Hilton's A Comprehensive Textbook of Classical Mathematics: A Contemporary Interpretation [11], which grew (considerably) out of a course in modern mathematics for teachers that was given at the University of Birmingham in England. The purpose was to treat topics from classical mathematics from a modern standpoint so as to bridge the gulf between school and university mathematics, the gulf between the eighteenth century mathematics used by scientists and engineers and the contemporary mathematics used by mathematicians. Teachers in junior colleges and community colleges ought to find the text especially useful, but it would be a handy reference for any secondary school or college teacher.

Two books on sets, [12] and [13], two on finite

mathematics, [14] and [15], and one on number theory [16], although not intended particularly for teacher education courses, could be used there. Two new college geometry textbooks, [17] and [18], could also be used by teachers in training. Blumenthal and Menger's Studies in Geometry [17] is the weightier (526 pages) and the more advanced; it covers lattice geometries, metric geometry, the geometry of projective and related spaces, and curve theory. Levy's Geometry: Modern Mathematics via the Euclidean Plane [18] focuses on transformations; it uses the Euclidean plane to introduce students to modern ideas concerning number systems, algebra, and geometry.

A statistics text that could be used either in a teacher education course or in a unit on statistics in high school is Noether's Introduction to Statistics: A Fresh Approach [19]. It presupposes only high school mathematics. Two calculus textbooks of greater-than-usual merit, [20] and [21], might be useful sources of ideas for teachers.

2. Books for professional reading

Teachers of calculus should be interested in Grattan-Guinness's account [22] of how the foundations of mathematical analysis developed, as reflected in the solution of the vibrating string problem. Three recent biographies of mathematicians--Charles Babbage [23], Carl Friedrich Gauss [24], and David Hilbert [25]--provide readable portraits of the men, their lives, and their

work that students and teachers alike will find enlightening.

Other books that a teacher might wish to read and pass on to his students include a history of systems of weights and measures (with arguments for and against U.S. conversion to the metric system) [26], and introduction to linear programming for the general reader [27], a collection of short, self-contained essays illustrating the elegant and the ingenious in mathematical thinking (the twenty-third volume in the monograph project of the School Mathematics Study Group) [28], a treatise on beauty in mathematics, built around the golden section [29], a problem-centered book on elementary number theory [30], and a reissued classic for young children that introduces geometry through paper-folding [31].

A valuable reference book for school libraries is the Handbook of Tables for Mathematics [32], available also in a students' version [33]. Libraries, high school teachers, and counselors should have the most recent edition of the Mathematical Association of America's guidebook to undergraduate and graduate departments in the mathematical sciences [34]--a goldmine of useful information. Similarly, the updated survey of curriculum projects in science and mathematics by the American Association for the Advancement of Science (AAAS) and the Science Teaching Center at the University of Maryland [35] provides a wealth of information not available elsewhere. The AAAS has also produced a new edition of their list of science books for the professional

library [36], which contains a 32-page annotated listing of titles in mathematics. A more comprehensive list for schools is provided by the fourth edition of Schaaf's The High School Mathematics Library [37].

3. Books on teaching methodology

The thirty-third yearbook of the National Council of Teachers of Mathematics (NCTM) is entitled The Teaching of Secondary Mathematics [38]. It contains sixteen chapters dealing with various components of the instructional process. Rather than duplicate existing methods books, the authors attempted to anticipate future problems of instruction, discussing strategies for putting theory into practice and providing illustrations of classroom applications. As a supplement to the yearbook, which treats questions of evaluation rather lightly, teachers will find James Wilson's paper on the evaluation of learning in secondary school mathematics [39] to be both a definitive statement and a practical guide.

A practical book of a different sort is Krulik's Handbook of Aids for Teaching Junior-Senior High School Mathematics [40], which shows how to construct and use 41 inexpensive devices for illustrating mathematical ideas. The NCTM has put together, in two volumes, thirteen units designed to provide meaningful mathematical experiences for low achievers in grades 5 to 8 [41]. The text is chiefly a teacher's guide; it is accompanied by a

teaching package of worksheets, transparencies, and activity materials.

For elementary school teachers, the NCTM has reprinted selected articles on the teaching of geometry that appeared in the Arithmetic Teacher from 1950 to early 1970 [42]. A teacher's guide for a unit in informal geometry that introduces concepts of transformation geometry, symmetry, and group theory [43] has also been published by the NCTM. Lovell's The Growth of Understanding in Mathematics: Kindergarten through Grade Three [44] uses Piaget's developmental theory as a framework for analyzing elementary mathematical concepts and suggesting appropriate instructional activities.

Other methodological works for elementary teachers include a book of readings [45], three textbooks, [46] to [48], and a study guide [49].

4. Books on research in mathematics education

Ashlock and Herman have prepared a collection of recent reports of research, curriculum development, and evaluation in elementary mathematics [50]--apparently the only collection of its kind now available. Reports of research that have appeared in book form are Dienes and Jeeves' second monograph on investigations of the learning of group structures [51], another in the series of textbook comparison reports from the National Longitudinal Study of Mathematical Abilities [52], and the fourth volume in a series

of translations from the Soviet literature on the pedagogy of mathematics [53].

5. Committee and conference reports

The Committee on the Undergraduate Program in Mathematics has issued a new report [54] in its series of recommendations for college mathematics programs. The report outlines a one-year basic mathematics course, Mathematics E, using computer-related mathematics, accompanied by a mathematics laboratory, and designed to replace current college courses in arithmetic and elementary algebra. A series of essays on the role of mathematics in the expansion and development of the social sciences can be found in the report of the Mathematical Sciences Panel of the Behavioral and Social Sciences Survey [55].

A sample curriculum in probability and statistics is presented in the first report of a Canadian committee studying the K-13 curriculum in arithmetic and algebra [56]. Probability and statistics was also the subject of the first international conference of the Comprehensive School Mathematics Program in March 1969. The papers delivered at the conference have been collected and published [57].

The report of a Conference on Responsibilities for School Mathematics in the 70's [58], held in San Francisco in October 1970 and sponsored by the School Mathematics Study Group, contains the major addresses, summaries of the discussions, and a proposal for a new organization for mathematics education.

References

[1] Allendoerfer, C. B.: Principles of arithmetic and geometry for elementary school teachers. New York: Macmillan, 1971.

[2] Fletcher, H.; Howell, A. A.: Mathematics with understanding, Book 1. Elsmford, N. Y.: Pergamon, 1970.

[3] Heinke, C. H.: Fundamental concepts of elementary mathematics. Encino, Calif.: Dickenson, 1970.

[4] Jackowski, A. J.; Sbrega, J. B.: Fundamentals of modern mathematics. Englewood Cliffs, N. J.: Prentice-Hall, 1970.

[5] Peterson, J. M.: Basic concepts of elementary mathematics. Boston: Prindle, Weber & Schmidt, 1971.

[6] Phelps, J.: Elementary mathematics--theory and practice. Belmont, Calif.: Brooks/Cole, 1970.

[7] Moser, J. M.: Modern elementary geometry. Englewood Cliffs, N. J.: Prentice-Hall, 1971.

[8] Hall, D. W.; Szabo, S.: Plane geometry: An approach through isometrics. Englewood Cliffs, N. J.: Prentice-Hall, 1971.

[9] Peterson, J. M.: Foundations of algebra and number theory. Chicago: Markham, 1971.

[10] Sloyer, C. W., Jr.: Algebra and its applications: A problem solving approach. Reading, Mass.: Addison-Wesley, 1970.

[11] Griffiths, H. B.; Hilton, P. J.: A comprehensive textbook of classical mathematics: A contemporary interpretation. New York: Van Nostrand Reinhold, 1970.

[12] Fairchild, W. W.; Tulcea, C. I. Sets. Philadelphia: Saunders, 1970.

[13] Hanna, S. C.; Saber, J. C.: Sets and logic. Homewood, Ill.: Richard Irwin, 1971.

[14] Goodman, A. W.; Ratti, J. S.: Finite mathematics with applications. New York: Macmillan, 1971.

[15] Hildebrand, F.; Johnson, C. G.: Finite mathematics. Boston: Prindle, Weber & Schmidt, 1970.

[16] Archibald, R. G.: An introduction to the theory of numbers. Columbus, Ohio: Merrill, 1970.

[17] Blumenthal, L. M.; Menger, K.: Studies in geometry. San Francisco: Freeman, 1970.

[18] Levy, L. S.: Geometry: Modern mathematics via the Euclidean plane. Boston: Prindle, Weber & Schmidt, 1970.

[19] Noether, G. E.: Introduction to statistics: A fresh approach. Boston: Houghton Mifflin, 1971.

[20] Herstein, I. N.; Sandler, R.: Introduction to the calculus. New York: Harper & Row, 1971.

[21] Hocking, J. G.: Calculus--with an introduction to linear algebra. New York: Holt, Rinehart & Winston, 1970.

[22] Grattan-Guinness, I.: The development of the foundations of mathematical analysis from Euler to Riemann. Cambridge, Mass.: M. I. T. Press, 1970.

[23] Halacy, D.: Charles Babbage: Father of the computer. New York: Crowell-Collier, 1970.

[24] Hall, T.: Carl Friedrich Gauss: A biography. Cambridge, Mass.: M.I.T. Press, 1970.

[25] Reid, C.: Hilbert. New York: Springer-Verlag, 1970.

[26] Donovan, F.: Prepare now for a metric future. New York: Weybright & Talley, 1970.

[27] Gass, S. I.: An illustrated guide to linear programming. New York: McGraw-Hill, 1970.

[28] Honsberger, R.: Ingenuity in mathematics. New mathematical library, No. 23. New York: Random House, 1970.

[29] Huntley, H. E.: The divine proportion: A study in mathematical beauty. New York: Dover, 1970.

[30] Wisner, R. J.: A panorama of numbers. Glenview, Ill.: Scott, Foresman, 1970.

[31] Young, G. C.; Young, W. H. A beginner's book of geometry. (2nd ed.) Bronx: Chelsea, 1970.

[32] Weast, R. C.; Selby, S. M. (Eds.): Handbook of tables for mathematics. Cleveland: Chemical Rubber Co., 1970.

[33] Selby, S. M. (Ed.): Standard mathematical tables. (18th ed.) Cleveland: Chemical Rubber Co., 1970.

[34] Hailpern, R. (Ed.): Guidebook to departments in the mathematical sciences in the United States and Canada. (4th ed.)

[35] Lockard, J. D. (Ed.): Seventh report of the International Clearinghouse on Science and Mathematics Curricular Developments. College Park: International Clearinghouse, Science Teaching Center, University of Maryland, 1970.

[36] Deason, H. J.: The AAAS science book list. (3rd ed.) Washington, D.C.: American Association for the Advancement of Science, 1970.

[37] Schaaf, W. L.: The high school mathematics library. (4th ed.) Washington, D.C.: National Council of Teachers of Mathematics, 1970.

[38] Rosskopf, M. F. (Ed.): The teaching of secondary school mathematics. Thirty-third yearbook. Washington, D.C.: NCTM, 1970.

[39] Wilson, J. W.: Evaluation of learning in secondary school mathematics. In B. S. Bloom; J. T. Hastings; G. F. Madaus (Eds.), Handbook on formative and summative evaluation of student learning. New York: McGraw-Hill, 1971. Pp. 643-696.

[40] Krulik, S.: A handbook of aids for teaching junior-senior high school mathematics. Philadelphia: Saunders, 1971.

[41] Chandler, A. M. (Ed.): Experiences in mathematical ideas. Vols. 1 and 2. Washington, D.C.: NCTM, 1970.

[42] Brydegaard, M.; Innskeep, J. E., Jr. (Eds.): Readings in geometry from the "Arithmetic Teacher." Washingron, D.C.: NCTM, 1970.

[43] Walter, M. I. Boxes, squares, and other things: A teacher's guide for a unit in informal geometry. Washington, D. C.: NCTM, 1970.

[44] Lovell, K. The growth of understanding in mathematics: Kindergarten through grade three. New York: Holt, Rinehart & Winston, 1971.

[45] Schminke, C. W.; Arnold, W. R. (Eds.): Mathematics is a verb: Options for teaching. Hinsdale, Ill.: Dryden, 1971.

[46] Hirschi, L. E.: Building mathematics concepts in grades kindergarten through eight. Scranton, Penna.: International Textbook, 1970.

[47] Kramer, K. Teaching elementary school mathematics. Boston: Allyn & Bacon, 1970.

[48] May, L. J. Teaching mathematics in the elementary school. New York: Free Press, 1970.

[49] Stibal, W. O. Improving the teaching of modern mathematics in the elementary school. (Rev. ed.) Dubuque, Iowa: Kendall/Hunt, 1970.

[50] Ashlock, R. B.; Herman, W. L., Jr. (Eds.): Current research in elementary school mathematics. New York: Macmillan, 1970.

[51] Dienes, Z. P.; Jeeves, M. A.: The effects of structural relations on transfer. Psychological monographs on cognitive processes, Vol. 2. New York: Humanities Press, 1970.

[52] Carry, L. R.: Patterns of mathematics achievement in grades 7 and 8: X-Population. NLSMA reports, No. 11. Stanford, Calif.: School Mathematics Study Group, 1970.

[53] Kilpatrick, J.; Wirszup, I. (Eds.): Problem solving in geometry. Soviet studies in the psychology of learning and teaching mathematics, Vol. 4. Stanford, Calif.: SMSG, 1970.

[54] Committee on the Undergraduate Program in Mathematics: A course in basic mathematics for colleges. Berkeley, Calif.: CUPM, 1971.

[55] Kruskal, W. (Ed.): Mathematical sciences and social sciences. Englewood Cliffs, N. J.: Prentice-Hall, 1970.

[56] K-13 Arithmetic-Algebra Study Committee: K-13 mathematics: Some non-geometric aspects. Part 1. Statistics and probability. Toronto: Ontario Institute for Studies in Education, 1970.

[57] Råde, L. (Ed.): The teaching of probability and statistics. New York: Wiley, 1970.

[58] School Mathematics Study Group: Report of a conference on responsibilities for school mathematics in the 70's. Stanford, Calif.: SMSG, 1971.

J. Kilpatrick
June, 1972

Zentralblatt fur Didaktik der Mathematik

Report on the Literature in the United States, 1971, Part 2

The literature surveyed in this report consists of books on the pedagogy of mathematics published in the United States. The report covers the last three quarters of 1971, but it includes a few titles missed in previous reports.

1. Mathematics textbooks for teachers

Among the several textbooks for elementary school teachers, five, [1] to [5], are relatively comprehensive in content. The book by Dinese [1] spans modern elementary mathematics from sets to vector spaces, with attention to transformation geometry and logic. The others are somewhat more restricted in coverage. Forbes and Eicholz's book [2] gives a fairly rigorous development of concepts from the elementary school curriculum, together with some strategies for teaching the concepts. Scandura's book [4] contains even more material on teaching methodology and school learning.

The other textbooks for elementary school teachers are more focused in content. Two, [6] and [7], are designed for a course on number systems, and one [8] combines material on number systems with an introduction to algebraic concepts in a relatively rigorous and formal approach. The theory of elementary school arithmetic is developed in two books, [9] and [10]; elementary notions of geometry are given in three others, [11] to [13].

Textbooks for all-purposed liberal arts mathematics courses continue to turn up in quantity. Of the ten listed, [14] to [23], the most unusual is Jacobs's Mathematics: A Human Endeavor [19], which presents elementary content in an original, appealing manner. The other books generally contain more advanced content. Most of them would be useful references for junior or senior high school teachers; many contain interesting examples that teachers could use in class.

The textbook for secondary mathematics teachers by Peressini and Sherbert [24] is composed of self-contained chapters on such topics as set theory, number systems, graph theory, and the geometry of complex numbers--each accompanied by historical remarks and references. Several textbooks for college courses in algebra, [25] to [32], might be used with classes of secondary mathematics teachers. The most elementary of these books is the fifth edition of a widely used college algebra textbook [30]. Secondary mathematics teachers would find especially helpful two introductory treatments of abstract algebra, [25] and [27].

2. Books for professional reading

Two books, [33] and [34], have appeared that introduce the basic concepts of mathematical logic; teachers may find them useful for self-study. A short paperback on statistics [35] offers many examples and counterexamples that can be used in instruction. Students and teachers looking for applications of mathematics may be interested in Restle's introduction to mathematical models in psychology [36]. Two books of essays for the general reader on computers, [37] and [38], should also appeal to teachers and students alike.

Several important classics have been reissued recently, including an account of the geometric theories of the circle and sphere [39], an analysis of the mathematical references in Aristotle's writings [40], a new edition of Hilbert's Foundations of Geometry [41], and an examination of various attempts, successful and otherwise, to construct an angle trisector [42]. The National Council of Teachers of Mathematics (NCTM) has published in paperback [43] twenty-five "capsule" histories of topics in algebra that originally appeared in the thirty-first NCTM yearbook.

The history of non-decimal place-value numeration is exhaustively treated in a recent monograph [44]; teachers may find it a helpful source of information. Another treatise [45], in this case dealing with geometry, illustrates numerous relations between solids with excellent photographs and a lucid text. A popularization of mathematics for the layman [46] might offer some pedagogical hints for teachers; a translation of two volumes of essays by French mathematicians [47] might place in perspective some key mathematical ideas.

Eves has published a sequel to In Mathematical Circles: 360 additional anecdotes about mathematics and mathematicians that teachers can borrow for use in class [48]. A compendium of works about mathematics by non-mathematicians has been assembled by Linn [49]. Several books on recreational mathematics, [50] to [53], have appeared. One [53] is appropriate for junior high school students; the others are more advanced. A collection of seven essays by high scorers in the National High School Mathematics Contest on how mathematics is related to their subsequent careers [54] should be read by high school teachers and passed on to their interested students.

Recent books for the teacher's reference shelf include a library list for mathematics departments in two year colleges [55], a compilation of more than 600 activities for the elementary school mathematics classroom [56], a collection of geometry problems to supplement a regular course [57], an up-to-date bibliography of audio-visual materials for school mathematics course [58], and a definitive set of instructions for making models of the 75 known uniform polyhedra plus some stellated forms [59].

Of the numerous school mathematics textbooks that have been published recently, six merit special attention. Two textbooks have appeared that foreshadow the incursion of transformation geometry into the American high school curriculum. One contains material for a year course [60]; the other is designed to follow a compressed treatment of the standard Euclidean geometry course [61]. Four short experimental textbooks written for British secondary school students, [62] to [65], could be employed both as background reading and as sources of exercise material.

3. Books on teaching methodology

The informal mathematics classroom of the British primary school is the subject of a short, anecdotal book by Biggs [66], which includes some helpful references. Stern and Stern [67] offer a detailed introduction to their structural approach to arithmetic in a volume designed to accompany the Stern apparatus. A more conventional and comprehensive methods book for elementary school teachers is the second edition of the textbook by Heddens [68].

A research-based approach to the teaching of mathematics has been developed by Dienes and Golding [69], who use the results of their own and others' experimentation to derive instructional principles. Secondary school teachers will find the volume edited by Servais and Varga [70] a valuable set of essays by European mathematics educators on a variety of themes, such as the treatment of the axiomatic method in the classroom and a survey of the psychological and educational research related to the teaching of school mathematics. A wide-ranging bibliography, sample syllabi, and examples of classroom lessons are included. Bassler and Kolb [71] have put together a secondary mathematics methods textbook that is short on exposition and long on exercises and activities. The first fifteen chapters treat general pedagogical issues; the last five treat problems of teaching specific school subjects. Two anthologies of periodical articles of interest to secondary school teachers have appeared, [72] and [73].

An adaptation for mathematics educators of a general supervision model, dealing with curriculum development, inservice work, materials, and evaluation, has been published in paperback [73]. Collections of so-called "behavioral objectives" for mathematics are being assembled in various centers in the United States. One collection [75]--written by classroom teachers, tried out in schools, and used in a program of individualized instruction--is available as part of a set of four volumes, each concerning a school subject. A biannual journal for mathematics teachers in two year colleges [76] began publication in 1970; its emphasis is more on methodology than content.

4. Books on research in mathematics education

Reports of research that have appeared in book form are four more monographs from the National Longitudinal Study of Mathematical Abilities, [77] to [80], and the fifth volume in a series of translations from the Soviet literature on the pedagogy of mathematics [81].

A readable introduction to the concepts and writings of Piaget [82] has been added to the growing literature on his work. Also listed here--although equally appropriate to the next section--is the report of a conference on Piagetian research held at Columbia University in October 1970 [83]. The report contains the fourteen papers given at this conference of mathematics educators and psychologists.

5. Committee and conference reports

The Committee on the Undergraduate Program in Mathematics has issued two new reports in its series of recommendations for college mathematics programs. One outlines an undergraduate program for prospective graduate students in statistics that is designed for college mathematics departments having no specialized statistics program [84]. The other proposes a curriculum in computational mathematics for undergraduate mathematics majors [85]. A series of papers and recommendations on the place and purpose of computer sciences in secondary schools can be found in the report of a seminar of the Organization for Economic Cooperation and Development [86]. Recommendations for the teaching of computation, logic, and problem solving are presented in the second report of a Canadian committee studying the K-13 curriculum in arithmetic and algebra [87].

The International Commission on Mathematics Instruction has prepared a second volume of papers on issues and trends in mathematics teaching [88]. A nice supplement to the ICMI collection is the Secondary School Mathematics Curriculum Improvement Study's survey of trends and content in the secondary mathematics programs of several European countries and Japan [89]. Finally, the Project on the Education of Secondary School Teachers of Science and Mathematics has issued a series of guidelines for the planning, implementation, and evaluation of preservice education programs for secondary school science and mathematics teachers [90].

J. Kilpatrick, New York

References

[1] Dienes, Z. P.: The elements of mathematics. New York: Herder and Herder, 1971

[2] Forbes, J. E.; Eicholz, R. E.: Mathematics for elementary teachers. Reading, MA: Addison-Wesley, 1971

[3] Mizraki, A.; Sullivan, M.: Topics in elementary mathematics. New York: Holt, Rinehart & Winston, 1971

[4] Scandura, J. M.: Mathematics: Concrete behavioral foundations. New York: Harper & Row, 1971

[5] Smith, S. E., Jr.: Explorations in elementary mathematics. (2nd ed.) Englewood Cliffs, New Jersey: Prentice-Hall, 1971

[6] Hutton, R. L.: Number systems: An intuitive approach. Scranton, Pa: International Textbook, 1971

[7] Wolf, F. L.: Number systems and their uses. Waltham, MA: Xerox College Publishing, 1971

[8] Behr, M. J.; Jungst, D. G.: Fundamentals of elementary mathematics: Number systems and algebra. New York: Academic Press, 1971

[9] Peterson, J. A.; Hashisaki, J.: Theory of arithmetic. (3rd ed.) New York: Wiley, 1971

[10] Youse, B. K.: Arithmetic: An introduction to mathematics. San Francisco: Canfield Press, 1971

[11] Backman, C. A.; Cromie, R. G.: Introduction to concepts of geometry. Englewood Cliffs, New Jersey: Prentice-Hall, 1971

[12] Garner, M. V.; Nunley, B. G.: Geometry: An intuitive approach. Pacific Palisades, CA: Goodyear, 1971

[13] Young, J. E.; Bush, G. A.: Geometry for elementary teachers. San Francisco: Holden-Day, 1971

[14] Bosstick, M.; Cable, J. L.: Patterns in the sand: An exploration in mathematics. New York: Glencoe Press, 1971

[15] Buckeye, D. A.; Ginther, J. L.: Creative mathematics. San Francisco: Canfield Press, 1971

[16] Dowdy, S. M.: Mathematics: Art and science. New York: Wiley, 1971

[17] Godino, C. F.: Elementary topics in number theory, algebra, and probability. Boston: Allyn & Bacon, 1971

[18] Gross, H. I.; Miller, F. L.: Mathematics: A chronicle of human endeavor. New York: Holt, Rinehart & Winston, 1971

[19] Jacobs, H. R.: Mathematics: A human endeavor. San Francisco: Freeman, 1970

[20] Kaufmann, J. E.; Lowry, W. C.: The many facets of mathematics. Boston: Prindle, Weber & Schmidt, 1971

[21] Ohmer, M. M.: Mathematics for a liberal education. Reading, MA: Addison-Wesley, 1971

[22] Spector, L.: Liberal arts mathematics. Reading, MA: Addison-Wesley, 1971

[23] Spitznagel, E. L., Jr.: Selected topics in mathematics. New York: Holt, Rinehart & Winston, 1971

[24] Peressini, A. L.; Sherbert, D. R.: Topics in modern mathematics for teachers. New York: Holt, Rinehart & Winston, 1971

[25] Andree, R. V.: Selections from modern abstract algebra. (2nd ed.) New York: Holt, Rinehart & Winston, 1971

[26] Campbell, H. G.: Linear algebra with applications. New York: Appleton-Century-Crofts, 1971

[27] Maxfield, J. E.; Maxfield, M. W.: Abstract algebra and solution by radicals. Philadelphia: Saunders, 1971

[28] Liebeck, P.: Vectors and matrices. Elmsford, NY: Pergamon Press, 1971

[29] Richman, F.: Number theory: An introduction to algebra. Monterey, CA: Brooks/Cole, 1971

[30] Rosenbach, J. B.; Whitman, E. A.; Meserve, B. E.; & Whitman, P. M.: College algebra. (5th ed.) Waltham, MA: Xerox College Publishing, 1971

[31] Warner, S. Classical modern algebra. Englewood Cliffs, New Jersey: Prentice-Hall, 1971

[32] Weiss, E.: First course in algebra and number theory. New York: Academic Press, 1971

[33] Rogers, R.: Mathematical logic and formalized theories. New York: American Elsevier, 1971

[34] Stolyar, A. A.: Introduction to elementary mathematical logic. Cambridge, MA: M.I.T. Press, 1970

[35] Reichmann, W. J.: Use and abuse of statistics. Baltimore: Penquin Books, 1971

[36] Restle, F.: Mathematical models in psychology: An introduction. Baltimore: Penquin Books, 1971

[37] Desmonde, W. H.: Computers and their uses. (2nd ed.) Englewood Cliffs, New Jersey: Prentice-Hall, 1971

[38] Fenichel, R. R.; Weizenbaum, J. (Eds.): Computers and computation. San Francisco: Freeman, 1971

[39] Coolidge, J. L.: A treatise on the circle and the sphere. Bronx: Chelsea, 1971

[40] Health, T.: Mathematics in Aristotle. New York: Oxford University Press, 1970

[41] Hilbert, D.: Foundations of geometry. (2nd ed.) La Salle, IL: Open Court, 1971

[42] Yates, R. C.: The trisection problem. Washington, DC: National Council of Teachers of Mathematics, 1971

[43] National Council of Teachers of Mathematics: Historical topics in algebra. Washington, DC: NCTM, 1971

[44] Glaser, A.: History of binary and other nondecimal numeration. Southampton, PA: Author, 1971

[45] Holden, A.: Shapes, space, and symmetry. New York: Columbia University Press, 1971

[46] Hartkopf, R.: Math without tears. New York: Emerson, 1971

[47] Lelionnais, F. (Ed.): Great currents of mathematical thought. New York: Dover, 1971. 2 volumes

[48] Eves, H. W. Mathematical circles revisited: A second collection of mathematical stories and anecdotes. Boston: Prindle, Weber & Schmidt, 1971

[49] Linn, C. F.: Odd angles: Thirty-three mathematical entertainments. Garden City, NY: Doubleday, 1971

[50] Gardner, M.: Martin Gardner's sixth book of mathematical games from Scientific American. San Francisco: Freeman, 1971

[51] Hurley, J. F.: Litton's problematical recreations. New York: Van Nostrand-Reinhold, 1971

[52] Scripture, N.: Puzzles and teasers. New York: Van Nostrand-Reinhold, 1970.

[53] Seymour, D.; Laycock, M.; Holmberg, V.; Heller, R.; & Larsen, B.: Aftermath. Palo Alto, CA: Creative Publications, 1970. 4 vols.

[54] Turner, N. D. R. (Ed.): Mathematics and my career. Washington, DC: NCTM, 1971.

[55] Committee on the Undergraduate Program in Mathematics. A Basic library list for two year colleges. Berkely, CA: CUPM, 1971.

[56] Dumas, E.: Math activities for child involvement. Boston: Allyn & Bacon, 1971.

[57] Higgins, A.: Geometry problems. Portland, ME: J. Weston Walsh, 1971.

[58] Raab, J. A.: Audiovisual materials in mathematics. Washington, DC: NCTM, 1971

[59] Wenninger, M. J.: Polyhedron models. New York: Cambridge University Press, 1971.

[60] Coxford, A. F.; Usiskin, Z. P.: Geometry: A transformation approach. River Forest, IL: Laidlaw, 1971.

[61] Eccles, F. M.: An introduction to transformational geometry. Reading, MA: Addison-Wesley, 1971.

[62] School Mathematics Project: Linear algebra and geometry. Further mathematics, Vol. 1. New York: Cambridge University Press, 1970.

[63] School Mathematics Project: Vectors and mechanics. Further mathematics, Vol. 2. New York: Cambridge University Press, 1971.

[64] School Mathematics Project: Extensions of calculus. Further mathematics, Vol. 4. New York: Cambridge University Press, 1971.

[65] School Mathematics Project: Statistics and probability. Further mathematics, Vol. 5. New York: Cambridge University Press, 1971.

[66] Biggs, E.: Mathematics for younger children. New York: Citation Press, 1971.

[67] Stern, C.; Stern, M. B.: Children discover arithmetic: An introduction to structural arithmetic. (Rev. ed.) New York: Harper & Row, 1971.

[68] Heddens, J. W. Today's mathematics: A guide to concepts and methods in elementary school mathematics. (2nd ed.) Chicago: Science Research Associates, 1971.

[69] Dienes, Z. P.; Golding, E. W.: Approach to modern mathematics. New York: Herder & Herder, 1971.

[70] Servais, W.; Varga, T. (Eds.): Teaching school mathematics. Baltimore: Penquin Books, 1971.

[71] Bassler, o. C.; Kolb, J. R.: Learning to teach secondary school mathematics. Scranton, PA: International Textbook, 1971.

[72] Aichle, D. B.; Reys, R. E. (Eds.): Readings in secondary school mathematics. Boston: Prindle, Weber & Schmidt, 1971.

[73] McIntosh, J. A. (Ed.): Perspectives on secondary mathematics education. Englewood Cliffs, N. J.: Prentice-Hall, 1971.

[74] Henderson, G. L.: Mathematics supervisor's handbook. Columbus, OH: Merrill, 1971.

[75] Flanagan, J. C.; Shanner, W. M.; & Mager, R. F.: Behavioral Objectives: A guide to individualizing learning. Mathematics. Palo Alto, CA: Westinghouse Learning Press, 1971.

[76] Hashisaki, J. (Ed.): The Two-year College Mathematics Journal. Boston: Prindle, Weber & Schmidt, Vol. 1, 1970.

[77] Kilpatrick, J.; McLeod, G.: Patterns of mathematics achievement in grade 9: Y-Population. NLSMA reports, No. 13. Stanford, CA: School Mathematics Study Group, 1971.

[78] McLeod, G.; Kilpatrick, J.: Patterns of mathematics achievement in grade 10: Y-Population. NLSMA reports, No. 14. Stanford, CA: SMSG, 1971.

[79] Kilpatrick, J.; McLeod, G.: Patterns of mathematics achievement in grade 11: Y-Population. NLSMA reports, No. 15. Stanford, CA: SMSG, 1971.

[80] Travers, K. J.: Non-intellective correlates of under-and over-achievement in grades 4 and 6. NLSMA reports, No. 19. Stanford, CA: SMSG, 1971.

[81] Kilpatrick, J.; Wirszup, I. (Eds.): The development of spatial abilities. Soviet studies in the psychology of learning and teaching mathematics, Vol. 5. Stanford, CA: SMSG, 1971.

[82] Richmond, P. G.: An introduction to Piaget. New York: Basic Books, 1971.

[83] Rosskopf, M. R.; Steffe, L. P.; & Taback, S.: Piagetian cognitive-development research and mathematical education. Washington, DC: NCTM, 1971.

[84] Committee on the Undergraduate Program in Mathematics: Preparation for graduate work in statistics. Berkeley, CA: CUPM, 1971.

[85] Committee on the Undergraduate Program in Mathematics: Recommendations for an undergraduate program in computational mathematics. Berkeley, CA: CUPM, 1971.

[86] Organization for Economic Cooperation and Development: Computer sciences in secondary education. Washington, DC: OECD Publications Center, 1971.

[87] K-13 Arithmetic-Algebra Study Committee: K-13 mathematics: Some non-geometric aspects. Part 2. Computing, logic, and problem-solving. Toronto: Ontario Institute for Studies in Education, 1971.

[88] International Commission on Mathematics Instruction: New trends in mathematics teaching. Vol. 2. New York: Unipub, 1970.

[89] Secondary School Mathematics Curriculum Improvement Study: Mathematics education in Europe and Japan. SSMCIS bulletin, No. 6. New York: SSMCIS, Teachers College, Columbia University, 1971.

[90] American Association for the Advancement of Science; National Association of State Directors of Teacher Education and Certification: Guidelines and standards for the education of secondary school teachers of science and mathematics. Washington, DC: AAAS, 1971.

Literaturbericht aus den USA

Report on the Literature in the United States, 1972

The literature surveyed in this report consists of books on the pedagogy of mathematics published in the United States during 1972.

1. Mathematics textbooks for teachers

The deluge of mathematics content textbooks continues, as does the difficult task of locating those which will meet teacher and learner needs. The difficulty of listing potentially appropropriate texts is compounded by the wide diversity of courses available to secondary-school teachers.

For elementary-school teacher-preparation courses, the range is more defined and limited. Several texts, [1] to [4], have appeared on geometry for elementary-school teachers. Bouwsma [1] appears to be one of the best in terms of presentation and scope. The second edition of Smart [2] incorporates many of the more recent geometric topics; the emphasis is on an informal and intuitive approach.

For number-oriented courses, there is also some variety from which to select, [5] to [17]. One book that has been highly recommended is by Spragens [5]; he presents formal mathematics with explanations which should be meaningful to an elementary-school teacher. The revision by Ohmer, Aucoin, and Cortez [6] is also strong on content, but the student may need more guidance in ascertaining what is really appropriate for elementary-school classrooms. Another book which is highly recommended is an NCTM publication edited by Ruderman [7]; it is one component of a

program that includes teacher-training films and single-concept films for students. The focus is on content, but there are also extensive suggestions for teaching. Maxfield and Maxfield [8] presumes no background other than basic algebra and provides the prospective teacher with some opportunities to experiment with numbers.

Callahan, Sternberg, and Weiss [12] present a carefully selected and organized set of mathematics laboratory activities as they integrate mathematics content with activities illustrating mathematical principles.

Matchett and Snader [13] systematically develop standard elementary-school content in a book designed for independent study; some students might find it useful for review. A partially programmed workbook [14] is more limited. Among the general texts are three that might serve for a general review, [15] to [17].

For secondary-school teachers, Zehna and Johnson [18] present a semiaxiomatic approach for a course in set theory. Three books, [19] to [21], provide an introduction to number theory; Niven and Zuckerman [21] continues to be recognized as an outstanding text for the well-prepared student.

A survey of geometry by Eves [22] carries the same philosophy and spirit as the 1963 edition. It incorporates historical developments, foundations and a variety of geometries, with many excellent problems. Dodge [23] is intended particularly for the teacher of Euclidean geometry. Analytic geometry texts include two designed for a precalculus course, [24] and [25], and one very readable introduction to affine and projective planes, for advanced students [26].

Calculus books continue to abound, [27] to [43]; there is a range

of difficulty and a selection of approaches. Dorn, Bitter, and Hector [43] provide a welcome supplementary text: they augment the traditional first-year calculus course by illustrating a computer approach to many topics, cross-referenced to fifteen widely-used calculus texts. Anderson and Hall [44] is designed to bridge the gap between calculus and advanced calculus.

Abstract algebra is the topic of several books, [45] to [51], which vary in approach. Cockcroft [47], for instance, uses complex numbers as a vehicle for developing algebraic structures; Hall [48] uses many concrete illustrations, while Budden [45] provides hundreds of diagrams, for a valuable source of classroom examples. Ireland and Rosen [52] assume a knowledge of abstract algebra in a difficult but interesting text on number theory.

Other books are explicitly on linear algebra, [53] to [60], and differential equations, [61] to [68]; several, [62], [64], [66], [68], are recommended as excellent texts on this topic.

Youse [69] is a text for those who are familiar with calculus and are ready for a rigorous course in analysis. The text on complex variables [70] also requires a good background in basic calculus. Two texts on numerical analysis are noted, [71] and [72], which might serve as references for the teacher of advanced computer-mathematics courses.

2. Books for professional reading

Skemp [73] makes a significant contribution to mathematics education with The Psychology of Learning Mathematics, in which he presents his understanding of mathematics and psychology in a readable style, followed

by some "elementary mathematics from an adult viewpoint". Teachers at all levels should find it a useful book. SMSG has filled another need by publishing selected theoretical papers of William A. Brownell [74], who played a definitive role in elementary-school mathematics education. The ERIC Center for Science, Mathematics, and Environmental Education published a monograph [75] which explores the scope of meaningful instruction, the topic with which Brownell was closely identified.

The Thirty-fifth Yearbook of the NCTM [76] presents specific ideas and techniques to help the teacher of the slow learner teach for affective as well as cognitive goals. Research findings and techniques for selecting appropriate objectives are included as well as explicit discussion of various programs, materials, teaching styles, and activities.

Four publications present information on curriculum development projects: the first [77] cites over 300 elementary-school projects of which 28 are in mathematics; a second [78] presents an analysis of six well-known projects of the mid-60s; a third [79] indexes several science-mathematics programs by topic. The fourth is the most comprehensive: the Eighth Report of the International Clearinghouse on Science and Mathematics Curricular Developments [80], which presents extensive data on projects all over the world.

Several resources on history were published in 1972. One that has received much attention is that by Kline [81], in which the history of mathematics is organized around the central ideas of mathematical thought. Mathematics is identified with the mathematicians involved and is placed in the prevailing social and political perspective. Gillings [82] builds a case for Egyptian mathematical achievement, based on study of original

sources. The first of an anticipated three volumes with biographical sketches on mathematicians also appeared [83].

Many teachers as well as parents used Adler's first book on the "new mathematics"; now there is a revision [84]. Adler also edited another book of interesting readings about mathematics from varied literature [85]. And there is a bagful of books into which the teacher can dip for ideas to enjoy or to bring into the classroom. There are books of problems, [86] and [87]; puzzles, [88] to [90]; facts and fables [91]; questions that might be asked [92]. There is treatise on the arithmetic nature of Dedekind sums [93]; two books on Fibonacci sequences, [94] and [95]; one book on the golden section which illustrates ways in which mathematical ideas are interrelated [96]; and one presentation of geometric dissections [97]. Krulik [98] contains 36 activities for secondary-school mathematics laboratories, including activities for pre-algebra, algebra, geometry, topology, and probability and statistics.

Teachers may find that a guide to resources on space mathematics [99] is useful--or they can come down to earth with a book on statistical techniques [100]. For building background on the metric system, there is a programmed text [101], or a rationale for metrication [102]. Another book [103] presents 44 essays which explain how statistics and probability were used to solve real-life problems in a variety of fields. Crossley et al. [104] is a collection of six related lectures summarizing some of the most significant ideas of mathematical logic.

Other reference works, [105] to [109], include another edition of the NCTM listing of mathematics tests [105], a directory of mathematical historians [106], the fifth edition of a guidebook to departments of

mathematical sciences [107]. Among the biographies are ones on Einstein [110], Fourier [111], and Newton [112].

3. Books on teaching methodology

Two of the books on teaching elementary-school mathematics focus on diagnosis and remediation for specific computational abilities. Reisman [113] discusses specific case studies, with some explicit suggestions and diagnostic tests. Ashlock [114] provides guidance to the teacher in developing simple techniques for remediation. The reader's attention is focused on the sources of errors, rather than the number of errors.

Underhill [115] provides a strong theoretical base for mathematics teaching and then helps teachers to apply that base to instructional problems by providing a wide variety of specific examples. The second edition of Copeland [116] emphasises content more than methodology, but the strongest points are those at which he discusses Piagetian ideas on mathematics learning. Another second edition is Fehr and Phillips [117], with careful pedagogical analysis of the content of contemporary elementary-school mathematics. Computational technique and structure are emphasized.

Fletcher and Howell [118] present a brief introduction to mathematical concepts in each chapter, followed by a variety of related teaching techniques for middle-school mathematics. Two more Nuffield guides were published [119]. And Biggs [120] provides a series of specific practical suggestions for classroom use in mathematics laboratories. The book by Greenes, Willcut, and Spikell [121] presents many others, with open-ended problem solving as the central process.

One Canadian book deserves special mention, for there are few books

specifically for the teachers of young children, and this is a helpful one. Nelson and Liedtke [122] present a series of experiences for children aged 4 and 5 to help them to acquire a conceptual basis for school mathematics.

Sund and Picard [123] is a text concerned with the writing of all types of behavioral objectives. It gives examples, sets up criteria for selection, and gives help in writing instruments to measure progress toward these objectives.

Among the few books on methods of teaching secondary-school mathematics is the second edition of Johnson and Rising [125], designed to help the teacher select and use effective methods, with a balance of content and processes for using that content in teaching. Rising and Wiesen [126] is a collection of 86 readings in which the articles are related to six popular methods texts; categories by topic, basic classroom activity, special technques, and enrichment lessons make it more readily usable. Weiss [127] presents a review of secondary-school geometry with the added features of suggestions for motivation, visual aids, teaching strategies, student and teacher activities, and enrichment materials.

4. Books on research in mathematics education

To accompany the collection of theoretical papers by Brownell [74], SMSG has published a collection of some of his research articles [128]. Researchers welcome the re-appearance of these significant studies, most of which had an impact on practice in the mathematics classroom.

SMSG has also published most of the remaining studies that were planned as reports on the National Longitudinal Study of Mathematical Abilities

[129] to [145]. Among these is a report on attitudes [133], with the data indicating that attitudes tend to be less positive as students progress through the secondary school. Other reports present data on patterns and on correlates of achievement gleaned from the five-year study.

Still another SMSG publication is Volume VI of the Soviet Studies in the Psychology of Learning and Teaching Mathematics, this one on instruction in problem solving [146].

The ERIC Center developed several research reviews for mathematics educators, [75] and [147] to [149].

5. Committee and conference reports

The four reports from the CUPM, [150] to [153], each present suggestions or guidelines for teachers of college mathematics. The report by Jewett and Phelps [154] presents data from a survey by the CBMS about mathematics offerings from 2300 institutions.

Literaturverzeichnis

References

[1] Bouwsma, W. D.: Geometry for teachers. New York: Macmillan, 1972.

[2] Smart, J. R.: Introductory geometry: An informal approach. (2nd ed.) Monterey, CA: Brooks/Cole, 1972

[3] Behr, M. J.; Jungst, D. G.: Fundamentals of elementary mathematics: Geometry. New York: Academic Press, 1972

[4] Hutchinson, M. W.: Geometry: An intuitive approach. Columbus, OH: Merrill, 1972

[5] Spragens, W. H.: Mathematics for elementary teachers. Boston: Allyn & Bacon, 1972

[6] Ohmer, M. M.; Aucoin, C. V.; & Cortez, M. J.: Elementary contemporary mathematics. Lexington, MA: Xerox, 1972

[7] Ruderman, Harry (Ed.): Mathematics for elementary school teachers: The rational numbers. Washington, DC: National Council of Teachers of Mathematics, 1972

[8] Maxfield, J. E.; Maxfield, M. W.: Discovering number theory. Philadelphia: Saunders, 1972

[9] Turner, V. D.; Prouse, H. L.: Introduction to mathematics. Glenview, IL: Scott, Foresman, 1972

[10] Meserve, B. E.; Sobel, M. A.: Contemporary mathematics. Englewood Cliffs, NJ: Prentice-Hall, 1972

[11] Whitesitt, J. E.: Modern algebra for elementary teachers. Reading, MA: Addison-Wesley, 1972

[12] Callahan, J.; Sternberg, S.; & Weiss, E.: Modern elementary mathematics: A laboratory approach. Lexington, MA: Xerox, 1972

[13] Matchett, M. S.; Snader, D. W.: Modern elementary mathematics and Tests. Boston: Prindle, Weber & Schmidt, 1972

[14] Wheeler, R. E.; Wheeler, E. R.: A programmed study of number systems. Monterey, CA: Brooks/Cole, 1972

[15] Meserve, B. E.: An introduction to finite mathematics. Reading, MA: Addison-Wesley, 1972

[16] Mullins, E. E., Jr.; Rosen, D.: Concepts of probability. Tarrytown-on-Hudson. NY: Bogden & Quigley, 1972

[17] Witter, G. E.: The structure of mathematics: An introduction. Lexington, MA: Xerox, 1972

[18] Zehna, P. W.; Johnson, R. L.: Elements of set theory. (2nd ed.) Boston: Allyn & Bacon, 1972

[19] Agnew, J.: Explorations in number theory. Monterey, CA: Brooks/ Cole, 1972

[20] Long, C. T.: Elementary introduction to number theory. (2nd ed.) Lexington, MA: Heath, 1972

[21] Niven, I.; Zuckerman, H. S.: An introduction to the theory of numbers. (3rd ed.) New York: Wiley, 1972

[22] Eves, H.: A survey of geometry. (rev. ed.) Boston: Allyn & Bacon, 1972

[23] Dodge, C. W.: Euclidean gometry and transformations. Reading, MA: Addison-Wesley, 1972

[24] Morrill, W. K.; Selby, S. M.; & Johnson, W. G.: Modern analytic geometry. (3rd ed.) New York: Intext, 1972

[25] Smith, W. K.: Analytic geometry. Riverside, NJ: Macmillan, 1972

[26] Mihalek, R. J.: Projective geometry and algebraic structures. New York: Academic Press, 1972

[27] Begle, E. G.; Williams, L. B.: Calculus. (2nd ed.) New York: Holt, Rinehart & Winston, 1972

[28] Chover, J. The green book of calculus. Reading, MA: Benjamin, 1972

[29] Embry, M. R.; Schell, J.; & Thomas, J. P.: Calculus and linear algebra: An integrated approach. Philadelphia: Saunders, 1972

[30] McAloon, K.; Tromba, A.: Calculus of one variable, Volume 1BC and Calculus: Volume 1BCD. New York: Harcourt Brace Jovanovich, 1972

[31] Seeley, R. T.: Calculus of one variable. (2nd ed.) Glenview, IL: Scott, Foresman, 1972

[32] Curtis, P. C., Jr.: Calculus, with an introduction to vectors. New York: Wiley, 1972

[33] Duren, W. L., Jr.: Calculus and analytic geometry. Lexington, MA: Xerox, 1972

[34] Leithold, L.: The calculus with analytic geometry. (2nd ed.) New York: Harper & Row, 1972

[35] Moise, E. E.: Elements of calculus. (2nd ed.) and Calculus.(2nd ed.) Reading, MA: Addison-Wesley, 1972

[36] Roberts, A. W.: Introductory calculus with analytic geometry and linear algebra. (2nd ed.) New York: Academic Press, 1972

[37] Tierney, J. A.: Calculus and analytic geometry. (2nd ed.) Boston: Allyn & Bacon, 1972

[38] Curtis, P. C., Jr.: Multivariate calculus with linear algebra. New York: Wiley, 1972

[39] Fraleigh, J. B.: Calculus: A linear approach, Volume II. Reading, MA: Addison-Wesley, 1972

[40] Trench, W. T.; Kolman, B: Multivariate calculus with linear algebra and series. New York: Academic Press, 1972

[41] Williamson, R. E.; Crowell, R. H.; & Trotter, H. F.: Calculus of vector functions. (3rd ed.) Englewood Cliffs, NJ: Prentice-Hall, 1972

[42] Taylor, A.; Mann, W. R.: Advanced calculus. (2nd ed.) Lexington, MA: Xerox, 1972

[43] Dorn, W. S.; Bitter, G. G.; & Hector, D. L.: Computer applications for calculus. Boston: Prindle, Weber & Schmidt, 1972

[44] Anderson, K. W.; Hall, D. W.: Elementary real analysis. New York: McGraw-Hill, 1972

[45] Budden, F. J.: The fascination of groups. New York: Cambridge University Press, 1972

[46] Bundrick, C. M.: Leeson, J. J.: Essentials of abstract algebra. Monterey, CA: Brooks/Cole, 1972

[47] Cockcroft, W. H.: Complex numbers. New York: Wiley, 1972

[48] Hall, F. M.: An introduction to abstract algebra, Volume 1. (2nd ed.) New York: Cambridge University Press, 1972

[49] Hollister, H. A.: Modern algebra: A first course. New York: Harper & Row, 1972

[50] McCoy, N. H.: Fundamentals of abstract algebra. Boston: Allyn & Bacon, 1972

[51] Paley, H.; Weichsel, P. M : Elements of abstract and linear algebra. New York: Holt, Rinehart & Winston, 1972

[52] Ireland, K.; Rosen, M. I.: Elements of number theory: Including an introduction to equations over finite fields. Tarrytown-on-Hudson, NY: Bogden & Quigley, 1972

[53] Holn, F. E.: Introduction to linear algebra. Riverside, NJ: Macmillan, 1972

[54] Moore, J. T.: Elementary linear and matrix algebra: The viewpoint of geometry. New York: McGraw-Hill, 1972

[55] Beaumont, R. A.: Linear algebra. (2nd ed.) New York: Harcourt Brace Jovanovich, 1972

[56] Finkbeiner, D. T., II: Elements of linear algebra. San Francisco: Freeman, 1972

[57] Haggard, P. W.: Basic linear algebra. Boston: Allyn & Bacon, 1972

[58] Burton, D. M.: Abstract and linear algebra. Reading, MA: Addison-Wesley, 1972

[59] Cullen, C. G.: Matrices and linear transformations. Reading, MA: Addison-Wesley, 1972

[60] Zuckerberg, H. L.: Linear algebra. Columbus, OH: Merrill, 1972

[61] Goldberg, J. L.; Schwartz, A. J.: Systems of ordinary differential equations: An introduction. New York: Harper & Row, 1972

[62] Pennisi, L. L.: Elements of ordinary differential equations. New York: Holt, Rinehart & Winston, 1972

[63] Barrett, J. H.; Bradley, J. S.: Ordinary differential equations. New York: Intext, 1972

[64] Motteler, Z. C.: Introduction to ordinary differential equations. Boston: Prindle, Weber & Schmidt, 1972

[65] Simmons, G. F.: Differential equations with applications and historical notes. New York: McGraw-Hill, 1972

[66] Roxin, E. O.: Ordinary differential equations. Belmont, CA: Wadsworth, 1972

[67] Rainville, E. D.: Intermediate differential equations. (2nd ed.) New York: Chelsea, 1972

[68] Young, E.: Partial differential equations: An introduction. Boston: Allyn & Bacon, 1972

[69] Youse, B. K.: Introduction to real analysis. Boston: Allyn & Bacon, 1972

[70] Flanigan, F. J.: Complex variables: Harmonic and analytic functions. Boston: Allyn & Bacon, 1972

[71] Dorn, W. S.; McCracken, D. D.: Numerical methods with FORTRAN IV case studies. New York: Wiley, 1972

[72] Haggarty, G. B.: Elementary numerical analysis with programming. Boston: Allyn & Bacon, 1972

[73] Skemp, R. R.: The psychology of learning mathematics. Baltimore: Penguin Books, 1972

[74] Weaver, J. F.; Kilpatrick, J. (Eds.): The place of meaning in mathematics instruction: Selected theoretical papers of William A. Brownell. Stanford, CA: School Mathematics Study Group, 1972

[75] Weaver, J. F.; Suydam, M. N.: Meaningful instruction in mathematics education. Columbus, OH: ERIC Information Analysis Center for Science, Mathematics and Environmental Education, 1972

[76] Lowry, W. C. (Ed.): The slow learner in mathematics. Thirty-fifth Yearbook. Washington, DC: National Council of Teachers of Mathematics, 1972

[77] Henrie, S. N. et al. (Eds.): A sourcebook of elementary curricula programs and projects. San Francisco: Far West Laboratory for Educational Research and Development, 1972

[78] Sherman, H.: Common elements in new mathematics programs: origins and evolution. New York: Teachers College Press, 1972

[79] Alberti, D.; Laycock, M.: The correlation of activity-centered science and mathematics. Hayward, CA: Activity resources, 1972

[80] Lockard, J. D. (Ed.): Eighth report of the international clearinghouse on science and mathematics curricular developments, 1972. College Park, MD: Science Teaching Center, University of Maryland, 1972

[81] Kline, M.: Mathematical thought from ancient to modern times. New York: Oxford University Press, 1972

[82] Gillings, R. J.: Mathematics in the time of the pharaohs. Cambridge, MA: M.I.T. Press, 1972

[83] Fang, J.: Mathematicians from antiquity to today, Volume 1. Studies in the Nature of Modern Mathematics 12. Hauppauge, NY: Paideia Press, 1972

[84] Adler, I.: The new mathematics. (rev. ed.) New York: John Day, 1972

[85] Adler, I. (Ed.): Readings in mathematics, book 2. Lexington, MA: Ginn, 1972

[86] Ogilvy, C. S.: Tomorrow's math: Unsolved problems for the amateur. (2nd ed.) New York: Oxford University Press, 1972

[87] Summers, G. J.: Test your logic. New York: Dover, 1972

[88] Emmet, E. R.: Puzzles for pleasure. New York: Emerson Books, 1972

[89] Friend, J. N.: Numbers: Fun & facts. New York: Scribner's, 1972

[90] Kordemsky, B. A.: The Moscow puzzles: 359 mathematical recreations. New York: Scribner's, 1972

[91] Eves, H. W.: The other side of the equation. Boston: Prindle, Weber & Schmidt, 1972

[92] Linderholm, C. E.: Mathematics made difficult: A handbook for the perplexed. New York: World Publishing, 1972

[93] Rademacher, H.; Grosswald, E.: Dedekind sums: The Carus mathematical monographs, no. 16. Washington, DC: The Mathematical Association of America, 1972

[94] Bicknell, M.; Hoggatt, W. E., Jr. (Eds.): A primer for the Fibonacci numbers. San Jose, CA: The Fibonacci Association, 1972

[95] Brousseau, A.: Fibonacci and related number theoretic tables. San Jose, CA: The Fibonacci Association, 1972

[96] Runion, G. E.: The golden section and related curiosa. Glenview, IL: Scott, Foresman, 1972

[97] Lindgren, H.: Recreational problems in geometric dissections and how to solve them. (2nd ed.) New York: Dover, 1972

[98] Krulik, S.: A mathematics laboratory handbook for secondary schools. Philadelphia: Saunders, 1972

[99] Reynolds, T. D. (Ed.): Space mathematics: A resource for teachers. Washington, DC: National Aeronautics and Space Administration, 1972

[100] Crocker, A. C.: Statistics for the teacher: or how to put figures in their place. Baltimore: Penguin Books, 1972

[101] Ploutz, P. F.: The metric system, a programmed approach. Columbus, OH: Merrill, 1972

[102] A metric America: A decision whose time has come. Washington, DC: U.S. Government Printing Office, 1972

[103] Tanur, J. M.; Mosteller, F.; et al. (Eds.): Statistics: A guide to the unknown. San Francisco: Holden-Day, 1972

[104] Crossley, J. N.; Ash, C. J.; Brickhill, C. J.; Stillwell, J. C.; & Williams, N. H.: What is mathematical logic? New York: Oxford University Press, 1972

[105] Braswell, J. S.: Mathematics tests available in the United States. (3rd ed.) Washington, DC: National Council of Teachers of Mathematics, 1972

[106] May, K. O.; Gardner, C. M. (Eds.): World directory of historians of mathematics. Toronto: Historia Mathematica, 1972

[107] Hailpern, Raoul (Ed.): Guidebook to departments in the mathematical sciences in the United States and Canada, fifth edition. Washington, DC: The Mathematical Association of America, 1972

[108] Howson, A. G.: A handbook of terms used in algebra and analysis. New York: Cambridge University Press, 1972

[109] Selby, S. M.: CRC standard mathematical tables. (20th ed.) Cleveland: Chemical Rubber Co., 1972

[110] Hoffmann, B.: Albert Einstein: Creator and rebel. New York: Viking Press, 1972

[111] Grattan-Guiness, I.: Joseph Fourier, 1768-1830. Cambridge, MA: M.I.T. Press, 1972

[112] Whiteside, D. T. (Ed.): The mathematical papers of Isaac Newton. New York: Cambridge University Press, 1972

[113] Reisman, F. K.: A guide to the diagnostic teaching of arithmetic. Columbus, OH: Merrill, 1972

[114] Ashlock, R. B.: Error patterns in computation: A semi-programmed approach. Columbus, OH: Merrill, 1972

[115] Underhill, R. G.: Teaching elementary school mathematics. Columbus, OH: Merrill, 1972

[116] Copeland, R. W.: Mathematics and the elementary teacher. (2nd ed.) Philadelphia: Saunders, 1972

[117] Fehr, H. F.; Phillips, J. M.: Teaching modern mathematics in the elementary school. (2nd ed.) Reading, MA: Addison-Wesley, 1972

[118] Fletcher, H.; Howell, A. A.: Mathematics with understanding, book 2. Elmsford, NY: Pergamon Press, 1972

[119] Logic and Mathematics--The Later Primary Years. Nuffield Mathematics Project. New York: Wiley, 1972

[120] Biggs, E.: Mathematics for older children. New York: Citation Press, 1972

[121] Greenes, C.; Willcut, R.; & Spikell, M.; Problem solving in the mathematics laboratory: How to do it. Boston: Prindle, Weber & Schmidt, 1972

[122] Nelson, D.; Liedtke, W.: Mathematical experiences in early childhood. Toronto: Encyclopedia Britannica Publications, 1972

[123] Sund, R. B.; Picard, A. J.: Behavioral objectives and evaluational measures: Science and mathematics. Columbus, OH: Merrill, 1972

[124] Crowder, A. B., Jr.; Wheeler, O. B.: Elementary school mathematics: Methods and materials. Dubuque, IA: William C. Brown Co., 1972

[125] Johnson, D.; Rising, G. R.: Guidelines for teaching mathematics. (2nd ed.) Belmont, CA: Wadsworth, 1972

[126] Rising, G. R.; Wiesen, R. A. (Eds.): Mathematics in the secondary school classroom: Selected readings. New York: Crowell, 1972

[127] Weiss, S.: Geometry: Content and strategy for teachers. Tarrytown-on-Hudson, NY: Bogden & Quigley, 1972

[128] Weaver, J. F.; Kilpatrick, J. (Eds.): The place of meaning in mathematics instruction: Selected research papers of William A. Brownell. Stanford, CA: School Mathematics Study Group, 1972

[129] Wilson, J. W.; Cahen, L. S.; & Begle, E. G. (Eds.): Statistical procedures and computer programs. NLSMA Report No. 8. Stanford, CA: School Mathematics Study Group, 1972

[130] Wilson, J. W.: Patterns of mathematics achievement in grade 10: Z-population. NLSMA Report No. 16. Stanford, CA: School Mathematics Study Group, 1972

[131] Wilson, J. W.: Patterns of mathematics achievement in grade 11: Z-population. NLSMA Report No. 17. Stanford, CA: School Mathematics Study Group, 1972

[132] Romberg, T. A.; Wilson, J. W.: Patterns of mathematics achievement in grade 12: Z-population. NLSMA Report No. 18. Stanford, CA: School Mathematics Study Group, 1972

[133] Crosswhite, F. J.: Correlates of attitudes toward mathematics. NLSMA Report No. 20. Stanford, CA: School Mathematics Study Group, 1972

[134] Wilson, J. W.; Begle, E. G. (Eds.): Correlates of mathematics achievement: Attitude and role variables. NLSMA Report No. 21. Stanford, CA: School Mathematics Study Group, 1972

[135] Wilson, J.W.; Begle, E. G. (Eds.): Correlates of mathematics achievement: Cognitive variables. NLSMA Report No. 22. Stanford, CA: School Mathematics Study Group, 1972

[136] Wilson, J. W.; Begle, E. G. (Eds.): Correlates of mathematics achievement: Teacher background and opinion variables. NLSMA Report No. 23. Stanford, CA: School Mathematics Study Group, 1972

[137] Wilson, J. W.; Begle, E. G. (Eds.): Correlates of mathematics achievement: School-community and demographic variables. NLSMA Report No. 24. Stanford, CA: School Mathematics Study Group, 1972

[138] Wilson, J. W.; Begle, E. G. (Eds.): Correlates of mathematics achievement: Teacher assigned grades. NLSMA Report No. 25. Stanford, CA: School Mathematics Study Group, 1972

[139] Wilson, J. W.; Begle, E. G. (Eds.): Correlates of mathematics achievement: Summary. NLSMA Report No. 26. Stanford, CA: School Mathematics Study Group, 1972

[140] Begle, E. G.: The prediction of mathematics achievement. NLSMA Report No. 27. Stanford, CA: School Mathematics Study Group, 1972

[141] Begle, E. G.; Geeslin, W.: Teacher effectiveness in mathematics instruction. NLSMA Report No. 28. Stanford, CA: School Mathematics Study Group, 1972

[142] Branca, N.: Follow-up study of the NLSMA Z-population. NLSMA Report No. 30. Stanford, CA: School Mathematics Study Group, 1972

[143] Dodson, J. W.: Characteristics of successful insightful problem solvers. NLSMA Report No. 31. Stanford, CA: School Mathematics Study Group, 1972

[144] Bridgham, R. G.: The effects of different mathematics curricula on science achievement in the secondary school. NLSMA Report No. 32. Stanford, CA: School Mathematics Study Group, 1972

[145] Wilson, J. W.; Begle, E. G. (Eds.): Intercorrelations of mathematical and psychological variables. NLSMA Report No. 33. Stanford, CA: School Mathematics Study Group, 1972

[146] Kilpatrick, J.; Wirszup, I. (Eds.): Instruction in problem solving. Soviet studies in the psychology of learning and teaching mathematics, volume VI. Stanford, CA: School Mathematics Study Group, 1972

[147] Aiken, L. R., Jr.: Language factors in learning mathematics. Columbus, OH: ERIC Information Analysis Center for Science, Mathematics and Environmental Education, 1972

[148] Suydam, M. N.: A review of research on secondary school mathematics. Columbus, OH: ERIC Information Analysis Center for Science, Mathematics and Environmental Education, 1972

[149] Walbesser, H. H.; Eisenberg, T. A.: A review of research on behavioral objectives and learning hierarchies. Columbus, OH: ERIC Information Analysis Center for Science, Mathematics and Environmental Education, 1972

[150] Committee on the Undergraduate Program in Mathematics: Applied mathematics in the undergraduate curriculum. Berkeley, CA: CUPM, 1972

[151] Committee on the Undergraduate Program in Mathematics: Introductory statistics without calculus. Berkeley, CA: CUPM, 1972

[152] Committee on the Undergraduate Program in Mathematics: Suggestions on the teaching of college mathematics: A report of the panel on college teacher preparation. Berkeley, CA: CUPM, 1972

[153] Committee on the Undergraduate Program in Mathematics: Commentary on a general curriculum in mathematics for colleges. Berkeley, CA: CUPM, 1972

[154] Jewett, J.; Phelps, C. R.: Undergraduate education in the mathematical sciences, 1970-71. Washington, DC: Conference Board of the Mathematical Sciences, 1972

Literaturbericht aus den USA

Report on the Literature in the United States, 1973

Books on content and methodology for mathematics education which were published in the United States during 1973 are surveyed in this report.

1. Mathematics textbooks for teachers

Each year we witness the hopeful production of new books and new editions of old books to meet the continual need to develop the often-minimal mathematics background of prospective elementary-school teachers. Two of the 1973 crop which have been particularly recommended are Webber [1] and Wren [2], each presenting a careful, comprehensive development of the mathematics in elementary programs. Meserve and Sobel [3] relate number system concepts to the needs of elementary- and junior-high-school students, while McFarland and Lewis [4] integrate theory and skills to help prospective teachers relate the content to future teaching situations. Others, [5] to [7], present content which parallels that of elementary-school programs. One text [8] is on geometry; it encourages the student to experiment and test hypotheses.

For secondary-school teachers, Whitesitt [9] is recommended for presenting abstract algebra as an orderly structure, with an emphasis on rigorous proof. An advanced plane geometry text by Allen and Guyer [10] helps students to understand the axiomatic method. Smart [11] is designed for mathematics majors or minors;

various types of geometry are included. Several types of geometry are also briefly presented in one book which may be used as a supplementary text [12].

Preferences for other textbooks which might be used in mathematics courses for teachers vary widely, depending on the instructor and how he views the needs of students, as well as on the level of the course. For college algebra, there is a variety from which to select, including [13] to [17]. Among the texts with a focus on functions are [18] to [23]. Iglewicz and Stoyle [24] uses a problem-centered approach which stresses mathematical reasoning, and could be an excellent supplement to an introductory course.

Among linear algebra texts, [25] to [33] is Anton [25], which is clear, detailed, and moves from the concrete to the abstract. Bentley and Cooke [26] suggests integration of linear algebra and differential equations. Two others, [32] and [33], appear particularly appropriate for independent study.

The production of calculus texts of varied scope continues through every season. Thurston [34] is not heavily rigorous, but is sound and easy to [illegible]ehend. Stein [35] is clear, readable, and has numerous examples; Saltz [36] also has many illustrative exercises. Shanks and Gambill [37] attempts to help the student to gain a sound intuition about basic concepts while developing computational skill. Two others, [38] and [39], similarly take a casual, intuitive approach, while Flanders et al. [40] introduces topics through practice rather than theory. McNeary [41] could be used to supplement a basic calculus course, for which several other texts might also be considered, [42] to [44]. For longer courses, Gillman and McDowell [45]

and Greenspan and Benney [46] are suggested.

Several texts, [47] to [49], focus on probability. A readable and comprehensive text for a first course in logic is Byerly [50]. Ledermann [51] covers the fundamentals of group theory. And as a reference book for mathematicians, and especially college teachers of mathematics, Melzak [52] is recommended.

2. Books for professional reading

Several books are designed from an affective or liberal arts approach, to help the reader understand what mathematics is, [53] to [56], what mathematicians do [57], and the impact of mathematics on civilization [58].

In a critique of mathematics instruction, Kline [59] presents some general suggestions for alternatives. Drawing on the historical development of mathematics, he emphasises that rigor is relative, that terminology is worthless without meaning, that axiomatics do not promote understanding, that excessive use of symbols makes for increased memorizing, and that unnecessary new content adds to confusion.

The Thirty-fourth Yearbook of the National Council of Teachers of Mathematics [60] is a valuable source of information on instructional aids. The use of all types of materials and devices, including textbooks, computers, projections, models, and games, is discussed, with many illustrations and extensive lists of references. Another useful resource is the Thirty-sixth NCTM Yearbook [61], in which seven alternative approaches to the teaching of both informal and formal geometry are explored, after examination of the present status

of geometry in the curriculum.

Other references were also published by the NCTM: suggested lists of books for mathematics libraries, [62] and [63]; the third volume of sources of materials for recreational mathematics [64]; a collection of topics for mathematics clubs [65]; and a resource on perfect numbers [66]. Guidelines for the preparation of teachers were developed by an NCTM commission [67].

A collection of problems [68] from MAA contests could be used in classes or as challenging material for mathematics clubs. Posamentier and Wernick [69] presents constructions in a book which might be useful to both geometry students and teachers. A series of pamphlets by Mosteller et al. [70] offers real-life examples of a variety of statistical situations. Holt and Dienes [71] provides games for teaching children at all levels to learn, think, and do mathematics, while Holt and Marjoram [72] presents applications of mathematics models, providing good reading for secondary and college students. Spencer [73] provides a guide to the use of computers in secondary school education, with lists of available materials.

A valuable contribution on the development of mathematics among African tribes is provided by Zaslavsky [74]. Tables of numbers of various types are presented in several publications, [75] to [78]. Two more references provide guides to references: an annotated guide to 1600 books and monographs was prepared by Dick [79], while May [80] developed a classified list of the locations of information pertaining to mathematics, with 31,000 entries under 3,700 topics.

3. Books on teaching methodology

Many books focused on mathematics laboratories experiences. Reys and Post [81] is a psychologically oriented book rather than a book of laboratory activities, but it provides many practical suggestions. It develops an excellent base for both elementary and secondary pre- and in-service teachers to start developing a laboratory approach. Fitzgerald et al. [82] is the expanded second edition of another useful book on the laboratory approach. Kelley [83], Kennedy and Michon [84], and Moore [85] provide games and activities for elementary teachers. Eleven laboratory-session experiences for direct classroom use in the intermediate grades or junior high school are presented by Hooten and Mahaffey [86]. The materials have also been found to be useful for pre-service education.

Among the other books on methods of teaching elementary school mathematics, [87] to [94], are the second editions of D'Augustine [87] and Swenson [88], both readable and helpful books. Grossnickle and Reckzeh's latest edition [89] continues to be especially good on the teaching of algorithms. Jensen [90] includes content as well as pedagogy which incorporates the use of materials; Ballew [91] also presents content and parallel pedagogy. Werner [92] discusses the teaching of integers. A summary of the primary-school content in English schools is the focus of one book [93].

Higgins [95] provides the student with knowledge of learning theory from which he may draw his philosophical basis for instruction, helping him to determine why he may teach as he does. To supplement this text or for independent use, Crosswhite et al. [96] is a collection of articles by authorities on learning. Specifically for

secondary-school methods classes, Scopes [97] presents goals and teaching strategies.

4. Books on research in mathematics education

Two chapters in a handbook on research [98] pertain to mathematics education. Overviews for the elementary-school and for the secondary-school levels are given, with selected findings cited.

Among the ERIC Center publications are reviews of research on cognition by Wittrock [99], on ability and creativity in mathematics by Aiken [100], and on the use of computers, [101] and [102].

Otaala [103] presents a study of children's abilities on measures of conservation, seriation, and classification, from a dissertation conducted in Africa.

5. Committee and conference reports

The Second International Congress at Exeter, England, is surveyed [104], with selected papers providing some interesting highlights. The reports from three National Science Foundation conferences, [105] to [107], are available through ERIC.

M. N. Suydam, Columbus, Ohio

Literaturverzeichnis

References

[1] WEBBER, G. C.: Algebraic structures for teachers. Boston: Houghton Mifflin, 1973

[2] WREN, F. L.: Basic mathematics concepts. (2nd ed.) New York: McGraw-Hill, 1973

[3] MESERVE, B. E.; SOBEL, M. A.: Foundations of number systems. Englewood Cliffs, NJ: Prentice-Hall, 1973

[4] McFARLAND, D.; LEWIS, E. M.: Introduction to modern mathematics. (2nd ed.) Lexington, MA: Heath, 1973

[5] BUSH, G. A.; YOUNG, J. E.: Foundations of mathematics with applications to the social and management sciences. (2nd ed.) New York: McGraw-Hill, 1973

[6] POLIS, A. R.; BEARD, E. M. L.: Fundamental mathematics for elementary teachers. New York: Harper & Row, 1973

[7] WHEELER, R. E.: Modern mathematics: An elementary approach. (3rd ed.) Monterey, CA: Brooks/Cole, 1973

[8] KEEDY, M. L.; NELSON, C. W.: Geometry: A modern introduction. (2nd ed.) Reading, MA: Addison-Wesley, 1973

[9] WHITESITT, J. E.: Principles of modern algebra. (2nd ed.) Reading, MA: Addison-Wesley, 1973

[10] ALLEN, F. B.; GUYER, B. S.: Basic concepts in geometry: An introduction to proof. Belmont, CA: Dickenson, 1973

[11] SMART, J. R.: Modern geometries. Monterey, CA: Brooks/Cole, 1973

[12] HEMMER, W.: Conceptions of space: Beginning geometries for college. San Francisco. Canfield Press, 1973

[13] FLANDERS, H.; PRICE, J. J.: Introductory college mathematics with linear algebra and finite mathematics. New York: Academic Press, 1973

[14] GOBRAN, A.: Algebra: A course for college students. Boston: Prindle, Weber & Schmidt, 1973

[15] LIAL, M. L.; MILLER, C. D.: Precalculus mathematics: Algebra, trigonometry, and analytic geometry. Glenview, IL: Scott, Foresman, 1973

[16] LORCH, E. R.: Precalculus: Fundamentals of mathematical analysis. New York: Norton, 1973

[17] WILLERDING, M. F.: A first course in college mathematics. Boston: Prindle, Weber & Schmidt, 1973

[18] FLANDERS, H.; PRICE, J. J.: Elementary functions and analytic geometry. New York: Academic Press, 1973

[19] FLEENOR, C. R.; SHANKS, M. E.; & BRUMFIEL, C. F.: The elementary functions. (2nd ed.) Reading, MA: Addison-Wesley, 1973

[20] FOBES, M. P.: Elementary functions: Backdrop for the calculus. New York: Macmillan, 1973

[21] MARCUS, M.; MINC, H.: Integrated analytic geometry and algebra with circular functions. Morristown, NJ: General Learning Press, 1973

[22] SWOKOWSKI, E.: Precalculus mathematics: A functional approach. Boston: Prindle, Weber & Schmidt, 1973

[23] WRIGHT, D. F.; LINDGREN, K. E.: Elementary functions: Pre-calculus mathematics. Lexington, MA: Heath, 1973

[24] IGLEWICZ, B.; STOYLE, J.: An introduction to mathematical reasoning. New York: Macmillan, 1973

[25] ANTON, H.: Elementary linear algebra. New York: Wiley, 1973

[26] BENTLEY, D. L.; COOKE, K. L.: Linear algebra with differential equations. New York: Holt, Rinehart & Winston, 1973

[27] BEAUREGARD, R. A.; FRALEIGH, J. B.: A first course in linear algebra with optional introduction to groups, rings, and fields. Boston: Houghton Mifflin, 1973

[28] JONES, B. W.: Linear algebra. San Francisco: Holden-Day, 1973

[29] PEARL, M.: Matrix theory and finite mathematics. New York: McGraw-Hill, 1973

[30] SCHNEIDER, H.; BARKER, G. P.: Matrices and linear algebra. (2nd ed.) New York: Holt, Rinehart & Winston, 1973

[31] ZELINSKY, D.: A first course in linear algebra. (2nd ed.) New York: Academic Press, 1973

[32] MERRIMAN, G. M.; STERRETT, A.: Matrices and linear systems: A programmed introduction. Menlo Park, CA: Benjamin, 1973

[33] SHIELDS, P. C.: Elementary linear algebra. (2nd ed.) New York: Worth, 1973

[34] THURSTON, H.: The calculus: An introduction. Englewood Cliffs, NJ: Prentice-Hall, 1973

[35] STEIN, S. K.: Calculus and analytic geometry. New York: McGraw-Hill, 1973

[36] SALTZ, D.: A short calculus: An applied approach. Pacific Palisades, CA: Goodyear Publishing Co., 1973

[37] SHANKS, M. E.; GAMBILL, R.: Calculus, analytic geometry, elementary functions. New York: Holt, Rinehart & Winston, 1973

[38] RATTI, J. S.; MANOUGIAN, M. N.: Introductory calculus with applications. Boston: Houghton Mifflin, 1973

[39] BURDETTE, A. C.: An introduction to analytic geometry and calculus. (rev. ed.) New York: Academic Press, 1973

[40] FLANDERS, H.; KORFHAGE, R. R.; & PRICE, J. J.: A first course in calculus with analytic geometry. New York: Academic Press, 1973

[41] McNEARY, S. S.: Introduction to computational methods for students of calculus. Englewood Cliffs, NJ: Prentice-Hall, 1973

[42] MULLINS, E. R., JR.; ROSEN, D.: Calculus concepts. Boston: Prindle, Weber & Schmidt, 1973

[43] PROTTER, M. H.; MORREY, C. M., JR.: Calculus for college students. (2nd ed.) Reading, MA: Addison-Wesley, 1973

[44] SEELEY, R. T.: Calculus of one and several variables. Glenview, IL: Scott, Foresman, 1973

[45] GILLMAN, L.; McDOWELL, R. H.: Calculus. New York: Norton, 1973

[46] GREENSPAN, H. P.; BENNEY, D. J.: Calculus: An introduction to applied mathematics. New York: McGraw-Hill, 1973

[47] DERMAN, C.; GLESER, L. J.; & OLKIN, I.: A guide to probability theory and application. New York: Holt, Rinehart & Winston, 1973

[48] FREUND, J. E.: Introduction to probability. Encino, CA: Dickenson, 1973

[49] [illegible]UGHBY, S. S.: Statistics and probability. Morristown, NJ: General Learning Press, 1973

[50] BYERLY, H. C.: A primer of logic. New York: Harper & Row, 1973

[51] LEDERMANN, W.: Introduction to group theory. New York: Barnes & Noble, 1973

[52] MEʼLZAK, Z. A.: Companion to concrete mathematics: Mathematical techniques and various applications. New York: Wiley, 1973

[53] BOWER, J. W.: Mathematics: A creative art. San Francisco: Holden-Day, 1973

[54] DURBIN, J. R.: Mathematics: Its spirit and evolution. Boston: Allyn & Bacon, 1973

[55] GRAHAM, M.: Mathematics: A liberal arts approach. New York: Harcourt Brace Jovanovich, 1973

[56] SMITH, K. J.: The nature of modern mathematics. Monterey, CA: Brooks/Cole, 1973

[57] HALL, R. S.: About mathematics. Englewood Cliffs, NJ: Prentice-Hall, 1973

[58] RESNIKOFF, H. L.; WELLS, R. O., JR.: Mathematics in civilization. New York: Holt, Rinehart & Winston, 1973

[59] KLINE, M.: Why Johnny can't add: The failure of the new math. New York: St. Martin's Press, 1973

[60] BERGER, E. (Ed.): Instructional aids in mathematics. Thirty-fourth Yearbook. Washington, DC: National Council of Teachers of Mathematics, 1973

[61] HENDERSON, K. B. (Ed.): Geometry in the mathematics curriculum. Thirty-sixth Yearbook. Reston, VA: National Council of Teachers of Mathematics, 1973

[62] HARDGROVE, C. E.; MILLER, H. F.: Mathematics library--elementary and junior high school. Washington, DC: National Council of Teachers of Mathematics, 1973

[63] SCHAAF, W. L.: The high school mathematics library. (5th ed.) Reston, VA: National Council of Teachers of Mathematics, 1973

[64] SCHAAF, W. L.: A bibliography of recreational mathematics, volume 3. Reston, VA: National Council of Teachers of Mathematics, 1973

[65] DALTON, L. C.; SNYDER, H. D. (Eds.): Topics for mathematics clubs. Reston, VA: National Council of Teachers of Mathematics, 1973

[66] SHOEMAKER, R. W.: Perfect numbers. Reston, VA: National Council of Teachers of Mathematics, 1973

[67] Guidelines for the preparation of teachers of mathematics. Reston, VA: National Council of Teachers of Mathematics, 1973

[68] SALKIND, C. T.; EARL, J. M. (Compilers.): The MAA problem book III. New York: Random House, 1973

[69] POSAMENTIER, A. S.; WERNICK, W.: Geometric constructions. Portland, ME: J. Weston Walch, 1973

[70] MOSTELLER, F. AND OTHERS (Eds.): Statistics by example. Reading, MA: Addison-Wesley, 1973

[71] HOLT, M.; DIENES, A.: Let's play math. New York: Walker, 1973

[72] HOLT, M.; MARJORAM, D. T. E.: Mathematics in a changing world. New York: Walker, 1973

[73] SPENCER, D. D.: A guide to teaching about computers in secondary schools. Ormond Beach, FL: Abacus Computer Corp., 1973

[74] ZASLAVSKY, C.: Africa counts. Boston: Prindle, Weber & Schmidt, 1973

[75] BICKNELL, M.; HOGGATT, V. E., JR.: A primer for the Fibonacci numbers. San Jose, CA: The Fibonacci Association, 1973

[76] BROUSSEAU, A.: Number theory tables. San Jose, CA: The Fibonacci Association, 1973

[77] BURINGTON, R. S.: Handbook of mathematical tables and formulas. (5th ed.) New York: McGraw-Hill, 1973

[78] SELBY, S. M.: CRC standard mathematical tables. (21st ed.) Cleveland: Chemical Rubber Co., 1973

[79] DICK, E. M.: Current information sources in mathematics: An annotated guide to books and periodicals, 1960-1972. Littleton, CO: Libraries Unlimited, 1973

[80] MAY, K. O.: Bibliography and research manual of the history of mathematics. Buffalo, NY: University of Toronto Press, 1973

[81] REYS, R. E.; POST, T. R.: The mathematics laboratory: Theory to practice. Boston: Prindle, Weber & Schmidt, 1973

[82] FITZGERALD, W. M. AND OTHERS: Laboratory manual for elementary mathematics. (2nd ed.) Boston: Prindle, Weber & Schmidt, 1973

[83] KELLEY, S. J.: Learning mathematics through activities. Cupertino, CA: Freel, 1973

[84] KENNEDY, L. M.; MICHON, R. L.: Games for individualizing mathematics learning. Columbus, OH: Merrill, 1973

[85] MOORE, C. C.: Why don't we do something different? Boston: Prindle, Weber & Schmidt, 1973

[86] HOOTEN, J. R., JR.; MAHAFFEY, M. L.: Elementary mathematics laboratory experiences. Columbus, OH: Merrill, 1973

[87] D'AUGUSTINE, C. H.: Multiple methods of teaching mathematics in the elementary school. (2nd ed.) New York: Harper & Row, 1973

[88] WENSON, E. J.: Teaching mathematics to children. (2nd ed.) New York: Macmillan, 1973

[89] GROSSNICKLE, F. E.; RECKZEH, J.: Discovering meaning in elementary school mathematics. New York: Holt, Rinehart & Winston, 1973

[90] JENSEN, R.: Exploring mathematical concepts and skills in the elementary school. Columbus, OH: Merrill, 1973

[91] BALLEW, H.: Teaching children mathematics. Columbus, OH: Merrill, 1973

[92] WERNER, M.: Teaching the set of integers to elementary school children. Dubuque, IA: Kendall/Hunt, 1973

[93] GARDNER, K. L.; GLENN, J. A.; & RENTON, A. I. G. (Eds.): Children using mathematics. New York: Oxford University Press, 1973

[94] HOLLIS L. Y.; HOUSTON, W. R.: Acquiring competencies to teach mathematics in elementary schools. Lincoln, NB: Professional Educators Publications, 1973

[95] HIGGINS, J. L.: Mathematics teaching and learning. Worthington, OH: Jones, 1973

[96] CROSSWHITE, F. J. AND OTHERS: Teaching mathematics: Psychological foundations. Worthington, OH: Jones, 1973

[97] SCOPES, P. G.: Mathematics in secondary schools: A teaching approach. New York: Cambridge University Press, 1973

[98] TRAVERS, R. M. W. (Ed.): Second handbook of research on teaching. Chicago: Rand McNally, 1973

[99] WITTROCK, M. C.: Recent research in cognition applied to mathematics learning. Columbus, OH: ERIC Information Analysis Center for Science, Mathematics, and Environmental Education, 1973

[100] AIKEN, L. R., JR.: Ability and creativity in mathematics. Columbus, OH: ERIC Information Analysis Center for Science, Mathematics, and Environmental Education, 1973

[101] HATFIELD, L. L.: Computer-extended problem solving and enquiry. Columbus, OH: ERIC Information Analysis Center for Science, Mathematics, and Environmental Education, 1973

[102] KIEREN, T. E.: Research on computers in mathematics education. Columbus, OH: ERIC Information Analysis Center for Science, Mathematics, and Environmental Education, 1973

[103] OTAALA, B.: The development of operational thinking in primary school children. New York: Teachers College Press, 1973

[104] HOWSON, A. G. (Ed.): Developments in mathematical education: Proceedings of the second international congress on mathematical education. New York: Cambridge University Press, 1973

[105] SPRINGER, G. (Ed.): Report of the conference on the k-12 mathematics curriculum, Snowmass, Colorado. Washington, DC: National Science Foundation, 1973. [ERIC: ED 081 643]

[106] The Cape Ann conference on junior high school mathematics. Washington, DC: National Science Foundation, 1973 [ERIC: ED 085 257]

[107] BEARD, E. M. L.; CUNNINGHAM, G. S. (Eds.): Middle school mathematics curriculum: A report of the Orono conference. Washington, DC: National Science Foundation, 1973 [ERIC: ED 085 258]